ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

MARCH 1961

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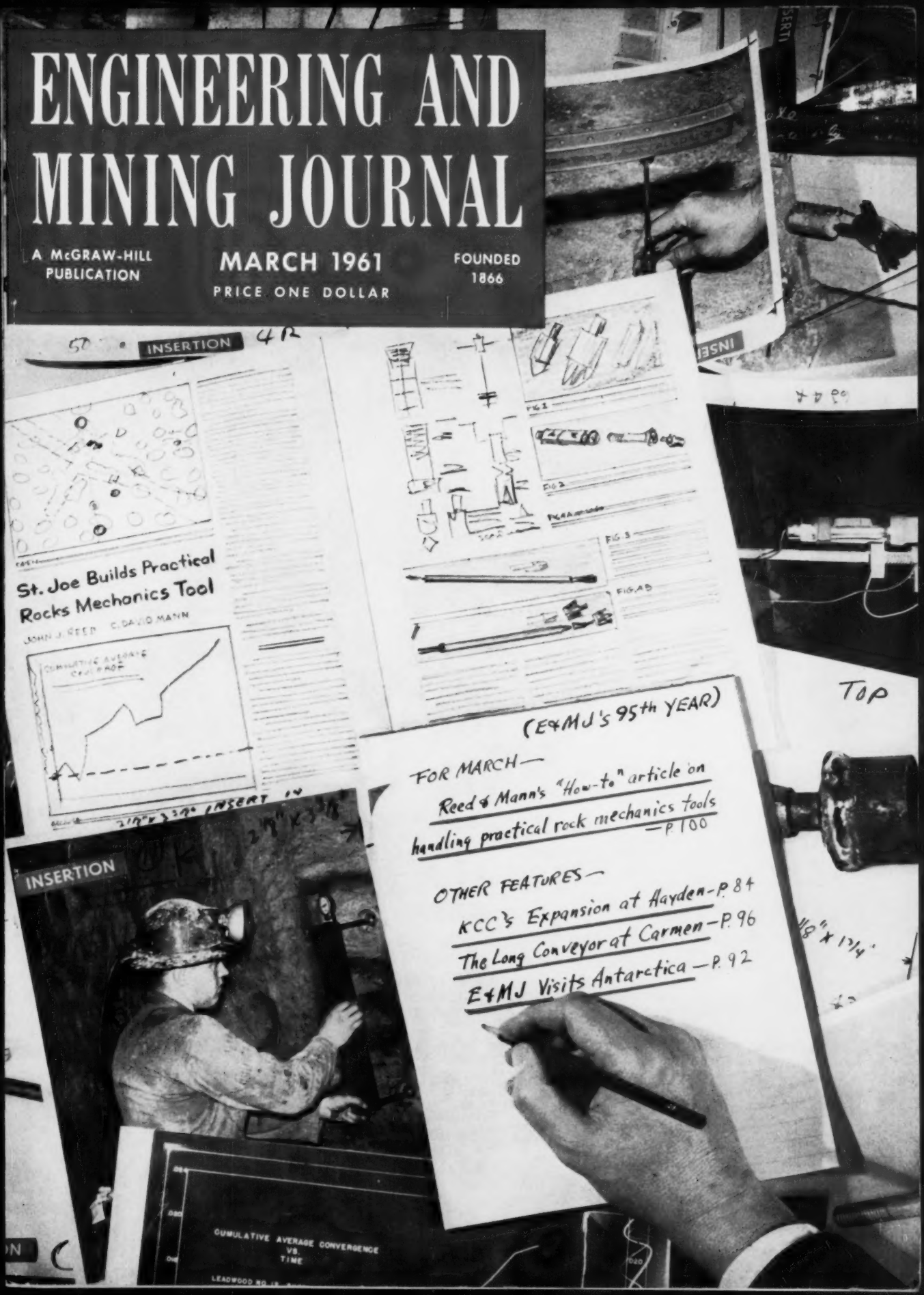
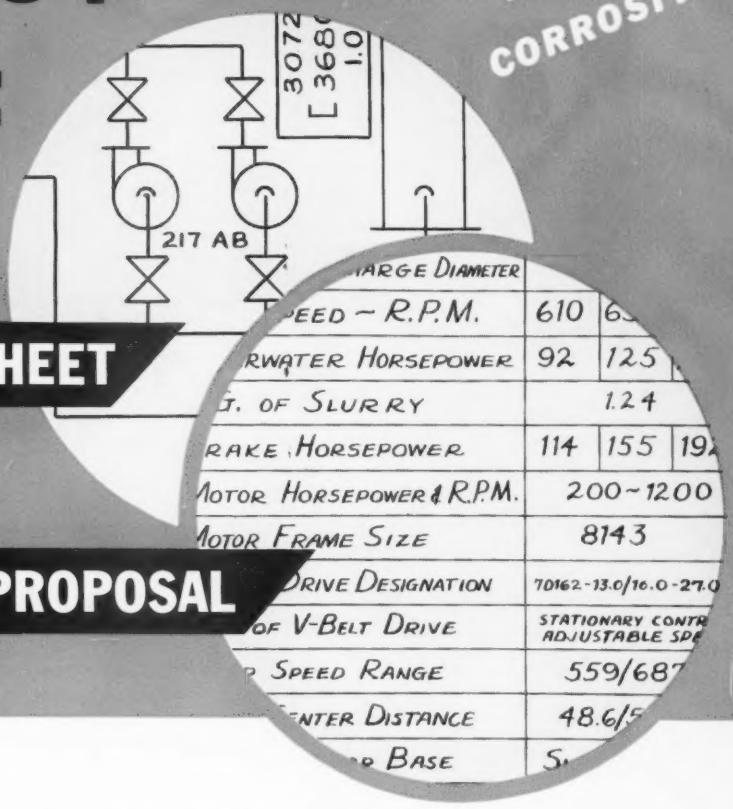

INSERTION
St. Joe Builds Practical Rocks Mechanics Tool
JOHN J. REED C. DAVID MANN
(E&MJ's 95th YEAR)
FOR MARCH—
Reed & Mann's "How-to" article on handling practical rock mechanics tools —P. 100
OTHER FEATURES—
KCC's Expansion at Hayden—P. 84
The Long Conveyor at Carmen—P. 96
E&MJ Visits Antarctica—P. 92
INSERTION
CUMULATIVE AVERAGE CONVERGENCE VS. TIME
TOP

How pumping problems are solved:

ABRASIVES
CORROSIVES



1 YOUR FLOWSHEET

2 OUR PROPOSAL

Like every other mining or processing operator, you wish to handle your material with the utmost efficiency and economy.

Your flowsheet, with significant data, will give to our engineers an outline of your pumping conditions and needs. It will provide their opportunity to propose a solution . . . from their store of application data built-up by continuous performance records . . . and from the exceptionally flexible A-S-H line of pumps. In return, our proposal and summary will give to you a clear, understandable recommendation—both comprehensive and specific in detail.

Not for just pumps, but for proper application, write us.

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HYDROSEAL and CENTRISEAL
SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

IF PURCHASES ARE ENDORSEMENTS...

P&H is the no. 1 choice of the mining industries

In recent years 68% of all American made 4.5 to 9 yard electric mining shovels bought for use throughout the world have been P&H

P&H has earned such widespread acceptance in the mining industries because of lower per-ton loading cost. This profit premium to owners of P&H Electrics results from these two basic advantages:

1. **Higher rate of production** made possible by exclusive, patented P&H design principles of MAGNETORQUE® Hoist Drive and Electronic Control. Both of these far-ahead design principles are the direct result of Harnischfeger designing and manufacturing its own electrical equipment—the *only* shovel manufacturer to do so.
2. **Vastly superior service and parts availability** reflecting our partnership of responsibility to you, the buyers of our products—a partnership of responsibility made possible by our *single source control* of electrical as well as mechanical components and their performance.

Your satisfaction with these advantages has made us The *World's Largest Builder of Full-electric Shovels*. Compare before you buy—write for complete information.

HARNISCHFEGER P&H
Milwaukee 46, Wisconsin

Mining Calendar

Western Mineral Congress, Ambassador Hotel, Los Angeles, March 20-24 1961

Fourth Symposium on Rock Mechanics, Pennsylvania State University, University Park, Pa., March 30-April 1 1961

Computers and Computer Applications in the Mineral Industry, a short course sponsored by the Colleges of Mines and of Engineering, University of Arizona, Tucson, April 4-7

American Society of Mechanical Engineers. 33rd annual conference and oil and gas power exhibit, Jung Hotel, New Orleans, April 10-13

International Symposium on Agglomeration, Philadelphia, April 12-14 1961

Pacific Northwest Metals and Minerals Conference, local sections, AIME-ASM, April 13-15

Wyoming Mining Association Convention, Rawlins, Wyo., April 21-22 1961

AIME-Southwest Mineral Industry Conference, Stardust Hotel, Las Vegas, Nev., April 24-25 1961

High Temperature Materials Conference, Cleveland Section, AIME, Hotel Pick-Carter, Cleveland, April 26-27 1961

16th Purdue Industrial Waste Conference, Purdue Memorial Center, Lafayette, Ind., May 2-4

Sixth Annual Uranium Symposium, Grants, N.M., May 12-14 1961

Canadian Nuclear Association meeting and conference, Lord Simcoe Hotel, Toronto, May 16-17

37th annual conference of the Lake Superior Mines Safety Council, Hotel Duluth, Duluth, Minn., May 25-26

11th National Chemical exposition, Chicago Section, American Chemical Society, Chicago, Sept. 5-8

Commemoration of the 50th Anniversary of Froth Flotation in the U.S., sponsored by MBD of SME, Cosmopolitan Hotel, Denver, Sept. 17-20 1961

Northwest Mining Association Convention, Davenport Hotel, Spokane, Wash., Dec. 2-3 1961

Coming Up

From Salt Lake—Does industrial engineering pay off? Facts and figures next month tell the story.

From Butte—Brand new equipment frequently needs adaptation for a specific job. A case history.

From Labrador—Major projects are tapping the famed Iron Trough.

95th YEAR OF PUBLICATION

ENGINEERING AND MINING JOURNAL

MARCH 1961

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SUBSCRIPTIONS: Send subscription correspondence and change of address to Fulfillment Manager, Engineering & Mining Journal, 330 West 42nd Street, New York 36, N.Y. Subscribers should notify Fulfillment Manager promptly of any change of address, giving old as well as new address, and including postal zone number, if any. If possible, enclose an address label from a recent issue of the magazine. Since copies are addressed one or two issues in advance, please allow one month in sending notice for the change to become effective

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30 tons of coal climb a mountain on B.F. Goodrich tires

IT'S RUGGED WORK, YET ROCK SERVICE TIRES GIVE 12% MORE SERVICE THAN OTHER MAKES, STRIP MINER FINDS

FROM deep in Pennsylvania's Panther Valley a fleet of 40 trucks haul 30- to 35-ton loads of coal and overburden up twisting mountain roads. These trucks, operated by Greenwood Stripping Corp., work 105 hours a week fighting tire-killing rocks and ruts. Ordinary tires couldn't stand the strain, but B.F.Goodrich Rock Service tires give 3,600 hours of service on the original tread—12% more than other makes!

The Rock Service tread has rugged, double-chevron cleats that dig in and pull in forward or reverse. In addition to Regular compound, this tire is now available in 2 new B.F.Goodrich compounds: Cut Protected to defy rock cuts and snags, and Heat Resistant to withstand dangerous heat build-up. Neither of these moneysaving compounds costs you a penny extra!

The B.F.Goodrich Flex-Rite Nylon cord construction resists heat blowouts and flex breaks—often outwears the thick Rock Service tread. Many users find Rock Service tires can be retreaded again and again. Your B.F.Goodrich dealer has tires for all types of mine work. See him today (he's listed under Tires in the Yellow Pages). *The B.F.Goodrich Company, Akron 18, Ohio.*

Specify **B.F.Goodrich Tubeless or tube-type tires when ordering new equipment**

B.F.Goodrich

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Articles in this issue of

ENGINEERING AND MINING JOURNAL

Continued from p 2

84 Ray Div.'s 50% Boost Pays Dividends in Efficiency & Safety

The concentrator expansion, last major unit in a $40-million expansion program that has completely transformed Kennecott's Ray Mines Div., has been completed. Now 22,500 tpd can be treated instead of the old 15,000. Because Ray Div. now can operate very efficiently, it can look forward to competing successfully with higher-grade copper producers, U.S. and worldwide.

Main new units are:

Track hopper of 6000 tons capacity; 100-ton ore cars dump directly into it.

Crushing building, secondary and tertiary-stage crushing; 7-ft standard belt that rises 200 ft, carrying ore 2200 ft to storage.

Fine-ore storage bin; "covered stockpile" with bottom-draw feeders holds almost a day and a quarter's tonnage.

New mill building; two-stage grinding, and sand-leaching take place in two parallel mill sections; extensive cyclone classification is practiced.

New LPF building, which houses the process which recovers nonsulphide copper minerals.

Water reclamation project; 325-ft thickener reclaims 3000 gpm mill water for reuse.

92 E&MJ Visits Antarctica

The Antarctica of Scott, Amundsen, Shackleton and Byrd no longer exists. Where once the adventurer-explorers maneuvered lightweight expeditions to merely set foot on virgin land, Government-supported projects with massive equipment and highly-qualified specialists are now systematically studying every aspect of the Continent. During the current National Science Foundation-U.S. Navy program, Operation Deep Freeze 61, geology and geophysics are being studied as never before—both from permanent stations and along elaborate traverse routes.

96 Mina Carmen and Its 7½-Mile Belt Conveyor System

One of the highlights of the recently completed mechanization of Mina Carmen, Chile, is a 7½-mile belt conveyor system, which is believed to be the longest ore-carrying conveyor system in the world. Dr. A. T. Yu tells how West South Overseas Corp. engineered the over-all modernization project which added 1-million tpy iron ore to Compania Minera Santa Fe's rapidly expanding production.

100 Practical Rock Mechanics Instrumentation

Once again, St. Joe's Mine Research Department has added a significant contribution to the mining industry. Rock mechanics, long a field more theoretical than practical, is now a useful part of St. Joe's operations. Thanks to Messrs. Reed and Mann, we have a practical do-it-yourself manual.

Starting with common sense and a good machinist, St. Joe built a number of relatively cheap components for convergence-measuring instruments. (Incidentally, the suppliers of the basic materials, their addresses, and the cost of the parts are also included.) Then, by putting these components together into a variety of instruments and by placing these instruments in permanent stations in selected locations, St. Joe was able to keep an eye on ground movement throughout the mine. By charting the movement against time (day by day, week by week, etc.), they could then spot areas where rock movement (convergence) seemed to be getting out of hand—and then take steps to prevent collapse before it happened.

And they went a step further. They created a device with a warning light attached for use in working stopes. Thus, a busy miner, deafened by noisy machinery, can see when the ground begins to converge—even if he can't hear or "sense" the movement.

new

JR-300 JACKDRILL

Challenges Comparison

50% Higher Drilling Speed and Easier Operation Assure Maximum Production at Lowest Capital Investment

Never before in the history of rock drilling has there been a feed-leg drill that could do so much, so easily, as Ingersoll-Rand's new JR-300 Universal Jackdrill. On performance alone, it is 40 to 60% faster than preceding models.

The JR-300 is a lightweight, completely integrated rock drill and flexible air-feed leg unit designed for faster, easier drilling in any position. Three feed legs are available with this new machine: conventional single-acting, telescopic and a new double-acting automatically retractable feed leg. All controls are conveniently grouped on the backhead and the feed handle has a two-position button for feed release or leg retraction which reduces steel changing time and speeds setups.

The same fine performance and design features are available in the new R-300 Stoper and J-300 Jackhamer, simplifying parts inventory where all three types of machines are used. For a new high in drilling speed and economy, ask your Ingersoll-Rand representative for a demonstration of the new JR-300 Universal Jackdrill—or send for a copy of Bulletin 4219 today.

Ingersoll-Rand
11 Broadway, New York 4, N.Y.

A CONSTANT STANDARD OF QUALITY IN EVERYTHING YOU NEED FOR DRILLING ROCK

95 YEARS OF MINING

The following news items are reprinted substantially as they first appeared in the AMERICAN JOURNAL OF MINING, the publication which became *E&MJ*.

All Sorts

NEW YORK, JANUARY 1887—A certain Dutch Justice of the Peace, over in Jersey, had a case before him, in which one party charged the other with biting his nose off. The defendant denied the accusation stating that the plaintiff had bitten it off himself. Our worthy judge, after mature deliberation, delivered the following opinion: "Mit Gott, everydings is possible. Vell, if Gott is willing a man shall bite his own nose off, he must do it. De brisoner is discharged, and de blaintiff can go home und never do so no more."

CHILE, JANUARY 1887—In some part of Chile and Bolivia, pure copper is found resembling that of the Lake Superior mines, and in other places in a form like fine sand. The latter class is called barilla, and is found on or near the surface of the ground, but so far in the interior that pack mules cannot be used profitably in transporting it across the deserts which intervene between the copper and the coast.

NEVADA, JANUARY 1887 — The Virginia City *Enterprise*, Dec. 13, says: About twenty prominent mill men met at the Yellow Jacket office, in Gold Hill, yesterday, and formed an association for the purpose of detecting and prosecuting amalgam thieves . . . This is an organization of great importance, as connected with the future prosperity of this State, and if by its means any one of the infernal rascals who have infested society and have been turning their attention of late to the robbing of the stages can be caught and judiciously hung, we shall not file our objections to the arrangement.

AUSTRALIA, JANUARY 1887—In New South Wales a new gold field has been discovered at the Weddin mountain, on Wood's run, thirty-five mines distant from Young, and is causing great excitement, and the roads are thick with people going there.

This month in

ENGINEERING AND MINING JOURNAL

Continued from p4

Behind the By-Lines

"Retiring from the Army in 1864, he entered upon the practice of his profession as mining and metallurgical engineer in New York. . . . This was almost coincident with the birth of mining in the United States. Indeed, except for gold mining, mostly placer, in California, and lode-mining on the Comstock, which had been discovered in 1859, there was no extensive mining going on in the great region . . . of the West. The prospecting that was to result in the discovery of the rich ore deposits of Eureka, Nevada and Cottonwood Canyons, in Utah, was just being begun. But the curtain of the stage of active mining was not to be raised for five years.

"Farther east, there was mining for copper in the Lake Superior region, and lead mining on a small scale in the Mississippi Valley. The St. Joseph Lead Co. and the Granby Co., to mine for lead and zinc, respectively, in Missouri, were just being organized.

"Truly, he entered mining at the psychologic time."

E&MJ's famed editor, W. R. Ingalls, is speaking above—speaking of Rossiter W. Raymond, editor from 1867 to 1874 and, in essence, the guiding spirit of the American Journal of Mining. The nominal editorship of the journal, from its founding in March 1866 to June 1867, was in the hands of George F. Dawson, a newspaperman who turned over the reins to Raymond after having published a great deal of the latter's work in the early issues of the paper.

Truly, Mr. Raymond entered mining at the psychologic time. And, 95 years ago this month, so did we. The history of Engineering & Mining Journal (Mr. Raymond chose the new name two years after he assumed editorship) reads like a history of the industry. We've been running some excerpts from the early issues on this page for more than a year now, and we hope you've enjoyed them as much as we have. We still stand a little in awe of those crowded 95 years—years of booms and bubbles, gold and ghosts, Wobblies and warpaths, metals, mines, and men.

We have resisted the temptation to make much of E&MJ's 95th year of continuous publication. Somehow, when you're that close to a centennial, it seems a little strained. Besides, there's so much that is new and pertinent to be told. We'll wait.

But we must confess to a faint twinge while we're waiting. There are stories to be told, of Rossiter himself and his contribution to the founding of AIME, of his war on "The Law of the Apex" in 1883, of his acquisition of a law degree in his later years, of his service in the War Between the States.

And he was only one of the editors who helped build the history of the magazine.

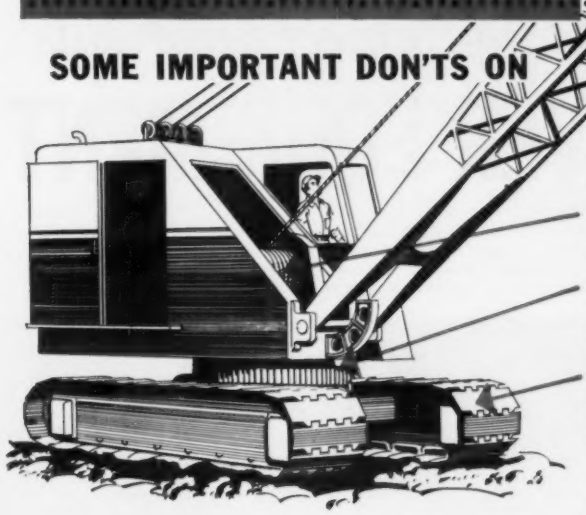
The list goes on: Rothwell, Hobart, Dr. David Day, T. A. Rickard ("a pepper-pot of a man, a burr under the saddle"), Walter Ingalls, Josiah E. Spurr, E. H. Robie, Arthur Allen, Dr. Howard C. Parmelee, Evan Just, Bob Ramsey, and the incumbent.

We're not alone in the anniversary lists. Our good friend West Lieb and his WALLACE MINER are noting that paper's 55th.

LUBE LOGIC

Three time and money savers

SOME IMPORTANT DON'TS ON POWER SHOVEL LUBRICATION

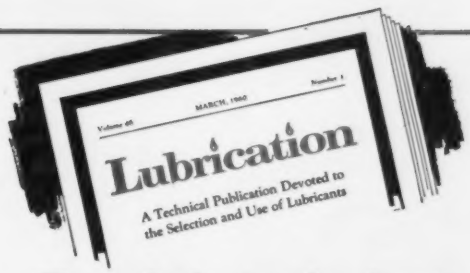


It's an old Texaco maxim that over-lubrication is sometimes worse than none at all, and there are three vital spots on power shovels where this is particularly true:

1) WIRE ROPE that winds onto drums fitted with clutches should be lubricated very sparingly; otherwise, the lubricant may get onto the clutch faces and cause slipping.

2) TURNTABLE ROLLER PATH should never be lubricated, unless it's the double-flange type with hook rollers. Lubricant will cause the rollers to slide and wear flat. Lubricate the bearings of turntable rollers sparingly to avoid drip on the turntable path.

3) TREADS, for instance, should never be lubricated at all. (We're talking about the tread only now; the track rollers or idling assemblies need very different treatment, which we discussed in the April/May 1960 Lube Logic). The pins that connect the individual treads are designed to operate without lubrication. Any oil or grease on these pins will pick up abrasive dirt which would act as a lapping compound on the pins and drastically shorten service life.



The whole truth about mobile lube rigs

What does it take to make a mobile lube rig? What do you put on it? How do you use it? The questions have been coming in so fast lately that Texaco has devoted a whole issue of its magazine, *Lubrication,* to answering them: the March 1960 issue, titled "Mobile Lubrication Equipment."

Lubrication is a major factor in cost control, and lube rigs can be a major factor in thorough maintenance, so send for your free copy of the March *Lubrication.* Supply of these valuable booklets is limited, so if you want one, send in your request *now* to Texaco Inc., 135 East 42nd Street, New York 17, N. Y., Department EM-21.

End-of-shift is best fueling time

They say there's a time and a place for everything, and for refueling your equipment the best time is the end of each day's work. And here are two reasons why: End-of-shift fueling minimizes the possibility of fuel-tank rusting, because there's no room for condensate to form in a tank that's full of fuel. And tank-bottom sediment, stirred up by incoming fuel, has a chance to settle down overnight, so it won't be drawn into the fuel line.

TEXACO LUBRICATION ENGINEERS

If LUBE LOGIC doesn't solve your problems, call your local Texaco man. Anytime, all the time, he's your best source of money-saving lubrication ideas. Don't forget that "Lubrication is a major factor in cost control."
Texaco Inc., 135 East 42nd Street, New York 17, N. Y.

Tune In: Texaco Huntley-Brinkley Report, Mon. Through Fri.-NBC-TV

TEXACO

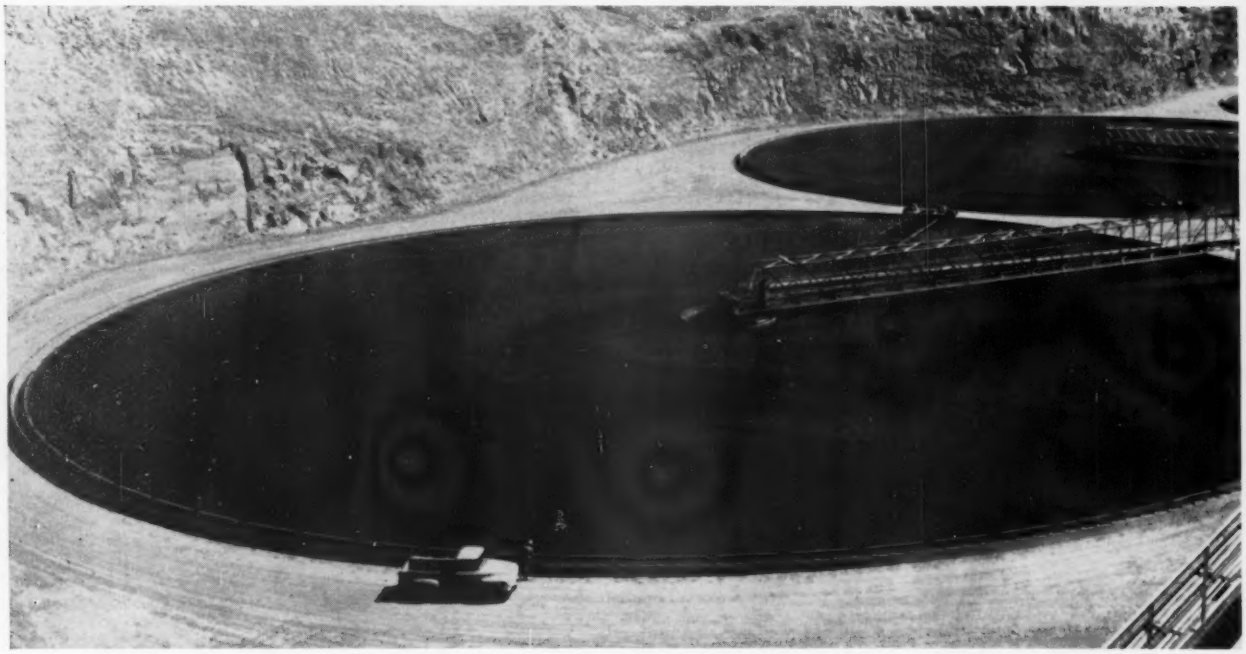
Throughout the United States
Canada • Latin America • West Africa

PICTURE STORY FROM TOQUEPALA

Spectacular Peruvian copper mining project highlights

DORR-OLIVER EQUIPMENT

DEWATERING TAILINGS: Three gigantic Dorr Type MC Traction Thickeners, covering almost 6 acres, dewater flow from 18% to 50% solids. Each unit is 325 feet in diameter and is designed to receive 10,500 tons of tailings.



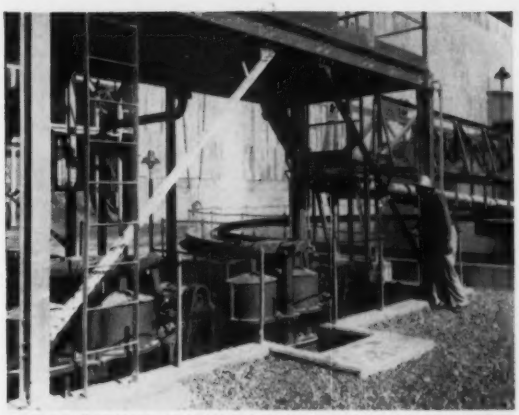
One of the great mining achievements of the century, Southern Peru Copper Corporation Project will wrest over 100,000 tons of blister copper every year from a 400-million-ton orebody. Fifty-two major items of Dorr-Oliver equipment play an essential part in the overall operation.

10 Dorr Thickeners dewater middlings, concentrates, tailings, and milk of lime; *28 Dorr Reciprocating Rake Classifiers* prepare flotation feed to specification; *7 Dorrclones* control the particle size of output from middling grinding circuit; *4 Dorr Hydroseparators* separate out middlings for regrinding; *1 Dorrco Slaker* prepares milk of lime from calcined sea shells; *2 Dorr Agitators* store milk of lime as a homogeneous suspension.

For information on Dorr-Oliver's complete line of equipment for the mining industry, write Dorr-Oliver Incorporated, Stamford, Connecticut.

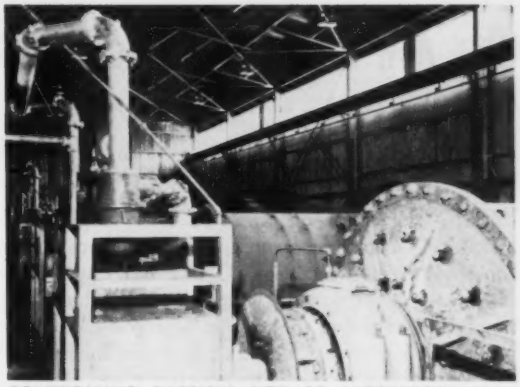
DORR-OLIVER

WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT

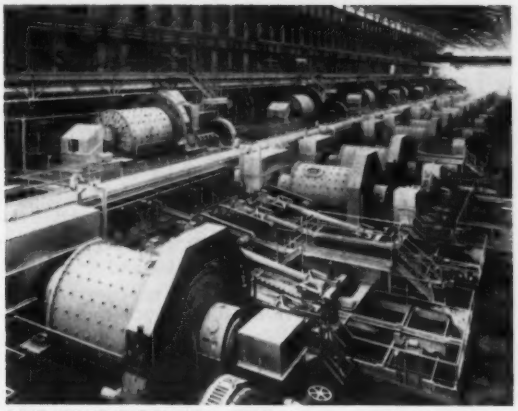


CONTROLLING WITHDRAWAL FROM THICKENERS: Close-up of Dorrco Type W, No. 6 Pumps used to control rate of withdrawal of underflow from Thickeners.

DEWATERING MIDDLINGS AND CONCENTRATES: Overall view of the six Dorr Type S-200 Torq Thickeners—each measuring 100 feet in diameter – used in the Toquepala operation. Thickeners in foreground and far background dewater middlings from 5% to 35% solids at rate of 1,190 tons of dry solids per day. Pair of Thickeners in the middle dewaters final concentrates from 20% to 65% at rate of 360 tons of dry solids per day. Concentrator building is at left.



CONTROLLING PARTICLE SIZE OF MIDDLINGS: Picture shows (left) one of seven Type FR, 12-inch DorrClones that control final size of particles from middlings grinding circuit at 150 mesh.



PREPARING FLOTATION FEED: Concentrator building houses 28 Dorr Reciprocating Rake Classifiers – Type HX – 8 feet wide, used in conjunction with rod and ball mills. Each of the seven Classifiers used for final separation overflows slurry containing 1,655 tons of plus 45 mesh solids per 24 hours.

PREPARING AND STORING MILK OF LIME: Foreground, a Dorrco No. 10 Lime Slaker prepares milk of lime by washing and removing unslakable components of the raw lime. Two Dorr Agitators – type AP, 35'x30' – in background provide storage for slurry until it is ready for use in Concentrator.

REPORT FROM WESTERN MATERIALS INC., PAMPA, TEXAS

"Our new 944 Traxcavator loads and levels nine 18-yd. trucks an hour

It gets its bucket full easier than other machines, is faster and handles better. Has plenty of reach for big trucks, too."

THAT's the word on the 944 from Craig Childers, Western's Plant Superintendent. And here's what the operator thinks about it, "I like the way it handles. It's really a fast-loading machine; and it has good balance and visibility. The idea of having the lift arms out front where you don't sit between them is great."

You can choose from three sizes in the new Traxcavator line. The 944 packs 105 HP and a 2 cu. yd. standard bucket—the big 966 at 140 HP carries a 2¾ cu. yd. standard bucket—and the 80 HP 922 has a 1¼ yd. bucket. All three mount a variety of buckets and attachments for handling various materials. And all three have what it takes to move more tons per hour and stay on the job month after month with far less maintenance.

Your Caterpillar Dealer has all the facts. Ask him to set up a Traxcavator demonstration on your job, and get a firsthand look at all the new ideas that are built into these machines. It'll be a real eye-opener.

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

CATERPILLAR

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TRAXCAVATORS ARE MAKING OTHER LOADERS OBSOLETE

Here's how the 922, 944 and 966 are built to do a better job for you.

CAT DIESEL ENGINES—Turbocharged for efficiency and quick acceleration. Optional gasoline engines for the 922 and 944.

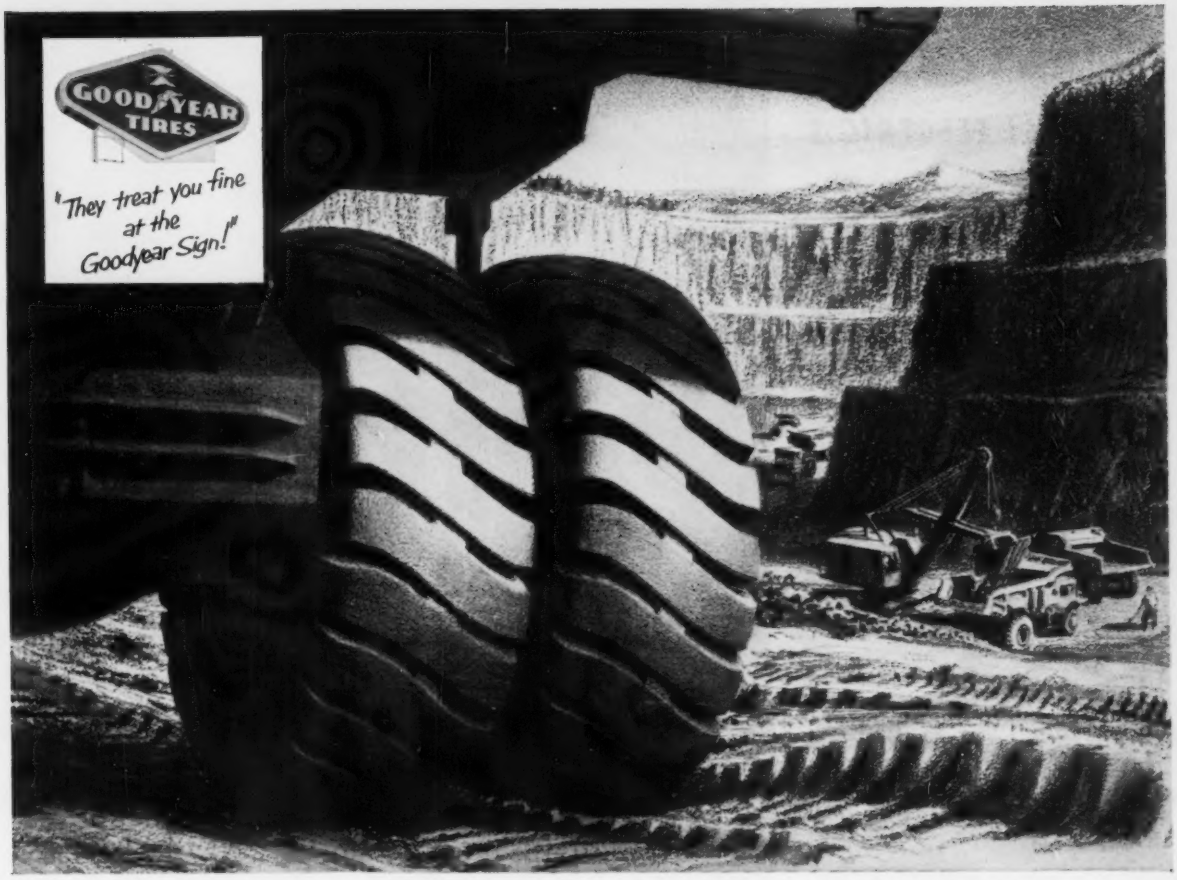
CAT POWER SHIFT TRANSMISSION—gives instant shifting, forward and reverse, 1st and 2nd speeds. High and low range selector also provides two-wheel drive for roading, four-wheel drive for power and traction in work cycles.

OPERATOR SAFETY—Lift arms and cylinders are forward of the operator and cockpit. Visibility is excellent and access is easy... up three wide steps.

LONG REACH—With the lift arms up front, the reach at dumping height of the new Traxcavators is impressive: 57″ on the 966, 51″ on the 944 and 41″ on the 922.

OPERATOR CONVENIENCES—Bucket controls have automatic positioners to speed every cycle; machine controls are all power boosted for easy operation. Dual brakes give operator choice of braking with or without transmission engaged.

FULL LINE OF ATTACHMENTS—Special material buckets, side dump buckets, forks, cabs, etc.



You never had 'em so tough!

HARD ROCK LUG XTRA TRED

Here it is! From Goodyear's advanced technology and processes–

HARD ROCK LUG XTRA TRED– the mine and quarry tire that's built with extra tread to take it where the going's tough!

It's made with 3-T Nylon Cord – triple-tempered by Tension, Temperature and Time – that makes *the world's toughest tire bodies.*

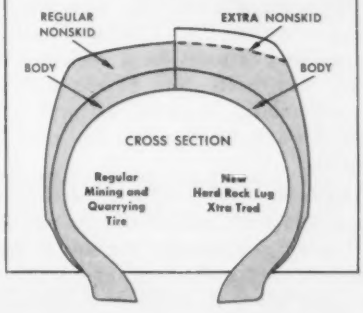
It has specially compounded rubber that embodies remarkable super-toughening agents for far greater chip-, wear- and penetration-resistance – that produces *the world's toughest treads.*

And, with its thicker nonskid tread depth (as much as 71% thicker) for harder-biting, longer-wearing lugs, you take out *more pay loads in less time and at lower cost*—with fewer maintenance headaches, too!

Ask your Goodyear dealer about Hard Rock Lug Xtra Treds, *now.*

Goodyear, Truck Tire Department, Akron 16, Ohio.

MORE AND TOUGHER RUBBER IN THE RIGHT PLACES!



THE WORLD'S TOUGHEST TRUCK TIRES BY

GOODYEAR

Xtra Tread–T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND

FOR THE FACTS ON GENERAL ELECTRIC'S MOTORIZED WHEEL DRIVE . . .

Ride Lectra Haul on the Mesabi

The minute you climb aboard this latest challenger to the Mesabi's tough operating conditions, you sense the massive power and performance that's at your control.

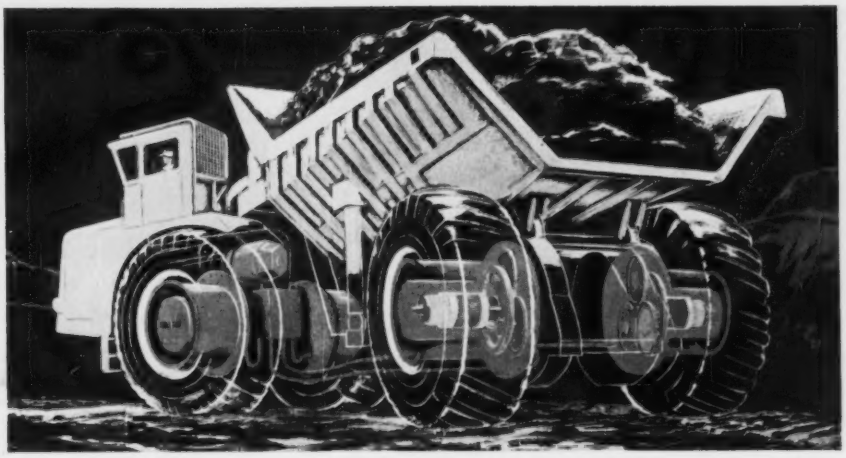
Powered by General Electric's new Motorized Wheel Drive, Lectra Haul gives you maneuverability and gradeability never before attained in rear-dump vehicles of its size.

The truck was built by Unit Rig & Equipment Company of Tulsa to satisfy the demand of users for a vehicle that would cut haul costs by combining maneuverability, capacity and performance. Electric drive makes this vehicle possible.

Here's how the new drive works: a traction motor is mounted in the rim of each wheel and bolted to the side of the vehicle . . . completely eliminating the need for axles, transmissions, differentials and drive shafts. Electric power for the Motorized Wheels is supplied by an engine-driven generator.

G-E's Motorized Wheel Drive is available in rim sizes from 29 in. to 45 in.

GENERAL ELECTRIC

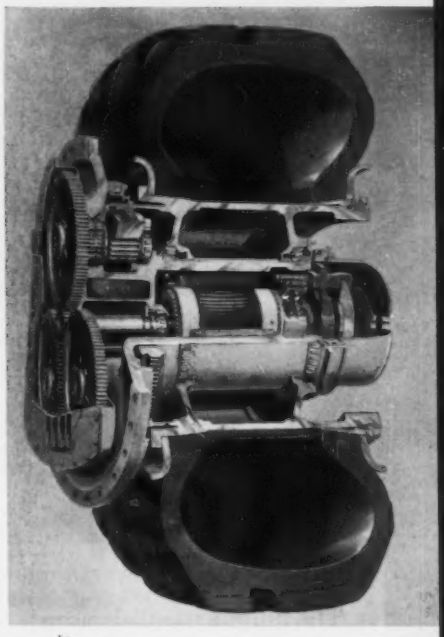


ALL-WHEEL DRIVE without separate engines, axles, transmissions, differentials, and drive shafts reduces maintenance, increases drive system reliability.

HIGHEST BRAKING CAPACITY without fading or mechanical wear results from dynamic braking allowing safe, high-speed operation.

64-TON CAPACITY with unmatched maneuverability and gradeability allows lowest cost per ton haulage, makes possible profitable mining of deeper pits and leaner ores.

SIMPLE OPERATION provides full control of traction and braking effort at all speeds, unequalled operating ease, safety, and maximum productivity.



PROPORTIONED POWER matches traction conditions at each wheel, providing more working hours under adverse weather conditions and terrain.

INCREASED GRADEABILITY through utilization of engine horsepower at all wheels permits operation over steeper grades at haul road speeds, reduces haul lengths and roadway maintenance.

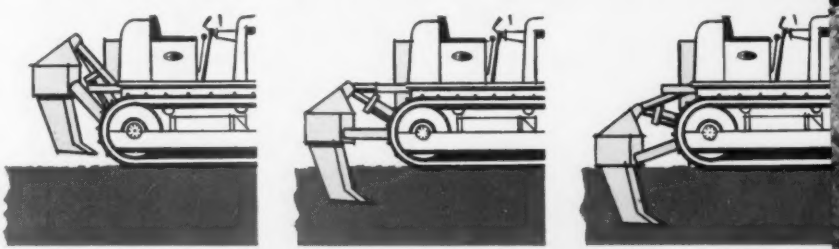
GREATER MANEUVERABILITY because motorized wheel drive enables Lectra Haul to combine the maneuverability of a king pin steer vehicle with the gradeability of a "weight on drivers," rigid frame vehicle.

FOR COMPLETE INFORMATION on how G-E's Motorized Wheel Drive can help you cut your haul costs, contact your nearby G-E Apparatus Sales Office, or write Section 103-05, Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC

The unique parallelogram design of Allis-Chalmers rippers keeps shanks at the most effective angle . . . up . . . halfway down . . . down full depth.



TOUGH TOOLS MATCH TOUGH JOB POWER

Allis-Chalmers rear-mounted rippers maintain most effective penetration angle at all depths . . . up front, specially designed bulldozers make most of HD-21's tremendous power.

Modern tractor power, *plus* modern ripper and dozer design, is making a big difference on today's tough jobs. With the HD-21 and ripper, for instance, up to 60,000 pounds of drawbar pull let you rip 'n' doze what you once shot and shoveled . . . puts one man, one modern machine in place of a typical 4-man blasting operation.

Allis-Chalmers leads the field in making rippers practical and effective for these tough jobs. The introduction of *parallelogram design* — unique Allis-Chalmers feature on these big HD-21 rippers — keeps shanks at most effective penetration angle *at all depths.* You get the *same* effective tooth angle *. . . up . . . halfway down . . . or working a full two feet deep!*

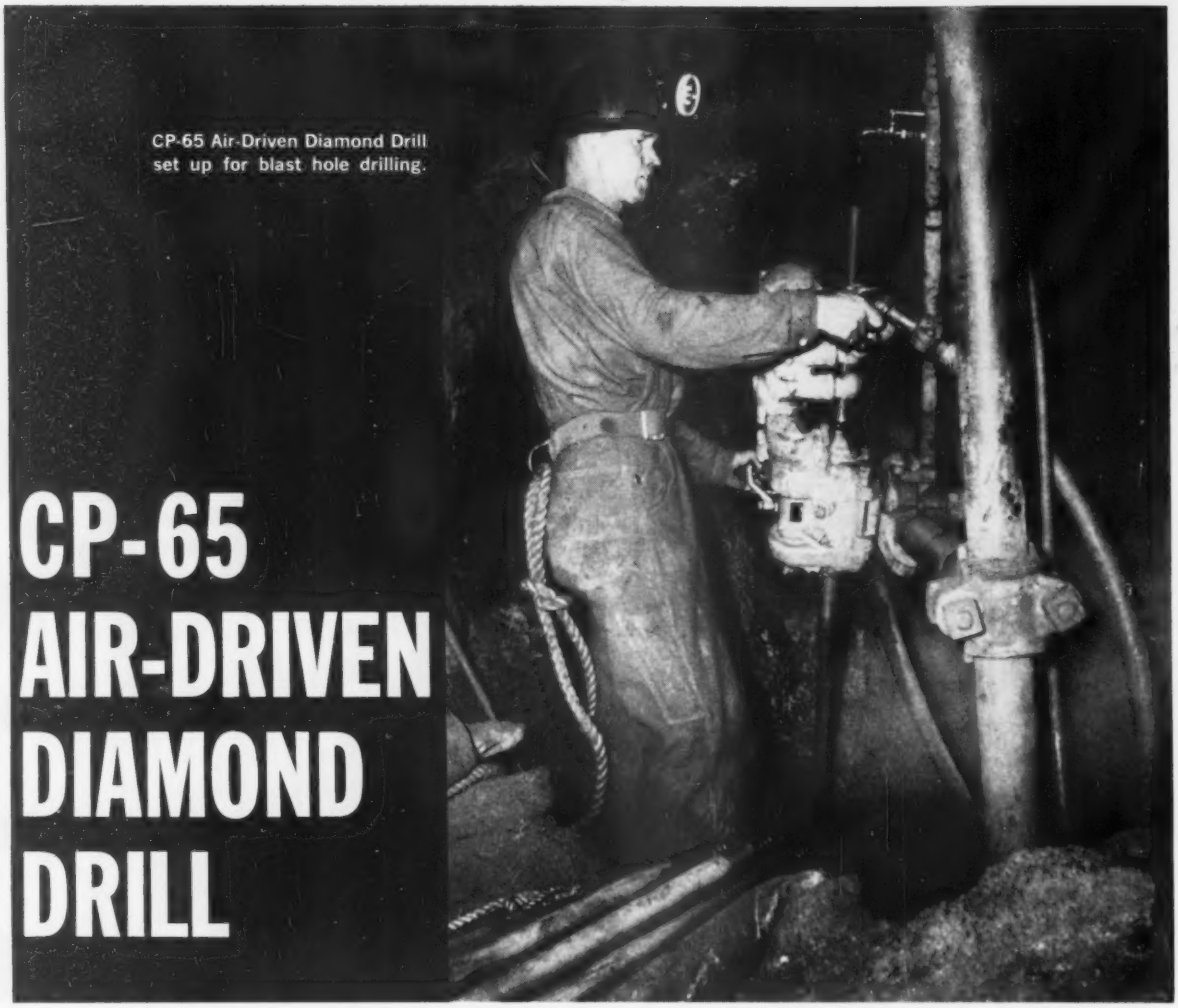
In addition, Allis-Chalmers dozer design utilizes the latest developments in steel to produce durability which makes the most of today's big tractor power without profit-killing maintenance and repair. Trunnions, "C" frames, struts and moldboards match the HD-21's brute strength. If you're bidding or working *any* tough materials, your Allis-Chalmers dealer will furnish all the facts on successful ripper/dozer application. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

Now available in Persian Orange or Allis-Chalmers Yellow at no extra cost.

move ahead with

ALLIS-CHALMERS

power for a growing world



CP-65 Air-Driven Diamond Drill set up for blast hole drilling.

CP-65 AIR-DRIVEN DIAMOND DRILL

deserves its reputation as the world's fastest

FOR BLAST HOLES AND CORING

Easy as a drifter to handle, the CP-65 Air-Driven Diamond Drill packs the power for fast footage in all formations.

The CP-65 features an all-new vane-type motor with 50% more power than its record breaking predecessor delivered . . . this extra power is producing faster drilling rates and greater capacity under all drilling conditions.

Reversibility speeds rod-handling. Makes up or unscrews rod joints quickly . . . gets back to the face, fast!

Rated at 600 foot capacity with EW Fittings. Keeps bit costs low . . . core recovery high because air motor permits delicate bit control.

Soundly engineered, balanced in design, the CP-65 with built-in swivel head is a compact 42½" unit, weighing only 200 pounds.

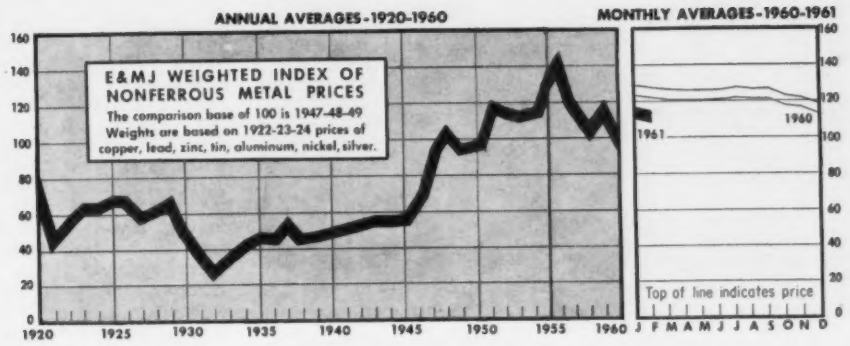
For full details on this "top-performance" Diamond Drill, write: *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.*

Chicago Pneumatic *8 East 44th Street, New York 17, N. Y.*

AIR COMPRESSORS • PNEUMATIC AND ELECTRIC TOOLS • AIR-BLAST BITS • DIAMOND DRILLS • REICHdrills • ROCK DRILLS

E&MJ OUTLOOK

PRICES


ANNUAL AVERAGES-1920-1960
MONTHLY AVERAGES-1960-1961
E&MJ WEIGHTED INDEX OF NONFERROUS METAL PRICES
The comparison base of 100 is 1947-48-49
Weights are based on 1922-23-24 prices of copper, lead, zinc, tin, aluminum, nickel, silver.
1961
1960
Top of line indicates price
J F M A M J J A S O N D

MARKETS

The drop in E&MJ's nonferrous metals price index from 116.1 in January to 115.2 in February can be attributed to the further slump in copper and zinc prices. An increase in tin of 0.6c has failed to offset the price index decline. Other metals were unchanged.

President Kennedy has asked Federal agencies to seek ways of helping the depressed domestic copper mining industry. Senate majority leader Mike Mansfield, (D. Mont.) will head the project, and will work directly with Federal agency chiefs. The White House shows limited interest in Mansfield's proposal for an international meeting to stabilize world copper prices.

•

AT HOME

OME has signed an exploration assistance contract with R. F. Beers, Inc., of Troy, N.Y., to explore for nickel in Knox County, Maine. The total cost of the work authorized under the contract is estimated at $48,186 of which the maximum Government participation is $24,093. (See E&MJ, May 1960)

100,000 tpy of aluminum reroll stock is the estimated output of a $30-million aluminum hot rolling mill to be built and jointly owned by Aluminium, Ltd., Bridgeport Brass Co., Cerro Corp., and Scovill Manufacturing Co. at Oswego, N.Y. Construction will begin within the next few months and completion is scheduled for 1963. The reroll stock is a heavy gage sheet which can be processed into lighter gages at the sheet mills of the four companies.

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LABOR

A recent AFL-CIO union membership survey has revealed that the level of membership has declined 1% in the last two years. (See p 21)

Enterprising members of Tile Setters Local no. 4 at Phoenix have bought a gold mine near Bumblebee Ariz., to occupy their time until the local unemployment situation improves. Although union officials aren't telling how much the mine cost them, similar 20-acre claims have gone for approximately $2,000.

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ABROAD

Two Japanese iron and steel firms, Yawata and Fuji, will import 10-million tons of iron ore from the Canadian Foreign Ore Development Corp., Santa Fe, Chile during the next ten years. The agreement is actually industry wide, as Yawata and Fuji will pool any purchases beyond 500,000 tpy maximum among eight major Japanese steel firms.

Kaiser Aluminum and Chemical Corp. and three Japanese metal fabricating firms are discussing the possibility of forming a completely integrated aluminum refining company in Japan. The three Japanese firms, Nisso Steel Manufacturing Co., Yawata Iron and Steel Co., and Kino Shita Sansho Co., are reported to have asked Kaiser to invest about one-fourth of the initial $5.58 million capital.

THIS MONTH IN MINING

ATTENDING the research symposium: (front, 1 to r) S. S. Saliya, India; N. V. Melnikov, USSR; L. A. Turnbull, U.S.; C. L. Wilson, U.S.; J. T. Whetton, England; U. Soe, Burma; (rear) G. B. Clark, U.S.; M. M. Protodyakonov, USSR; A. N. and P. H. Sevensma, Canada; D. F. Bedouret, France; K. D. Phan, Vietnam; W. C. Wilson, U.S.

(Photos by Rolla Daily News)

EARPHONED delegates followed talks in any of several simultaneous translations.

Rolla's International Mining Symposium

ENGINEERS, OPERATORS, and educators from 14 nations contributed papers and comment in English, French, German and (by translation) Russian at the Symposium on Mining Research at the Missouri School of Mines and Metallurgy, Rolla, Mo., Feb. 22-25. Sponsors of the symposium were MSM and the U.S. Bureau of Mines. Financial support was contributed by National Science Foundation, USBM, MSM and 12 mining companies and explosives manufacturers.

The tri-language exchange of information sessions covered a broad range of subjects with major emphasis on explosives and rock mechanics. In keeping with the truly international character of the meeting, papers were preprinted in English, French and German. During 20-minute digests of the papers, the subjects were translated into three languages and transmitted over short-wave radio to be received by the audience over portable IBM pocket-size transistor radios equipped with headphones and 5-channel selector switches.

Elmer Pehrson, chief, division of foreign activity, USBM, keynoted the symposium by stressing the need for accelerated research now, so that "staggering demands" for minerals which are now building up through world-wide development will be met. He noted that intense nationalism is now growing in certain areas which will result in the reluctance of some nations to part with their basic mineral resources. He foresaw the supplying of world mineral needs if intensified research can be directed now at developing new exploration techniques, new mining and mineral processing methods, and substitutes for scarce mineral commodities.

Hard-rock miners were intrigued by a paper, "Influence of Explosive Charge Designed on Results of Blasting" by Prof. N. V. Melnikov, of the USSR Academy of Sciences, which was presented in English. Prof. Melnikov noted that only 1- to 7% of the energy of explosives is used to propel particles, and that only 15 to 25% of the energy produces fragmentation. Arguing that these efficiencies were too low, Melnikov explained procedures to use the power of explosives more effectively. Slides showed two blasts in a Russian taconite orebody, one where conventional methods produced huge blocky chunks, and another showing remarkably uniform fragmentation. Secret of the blast, Melnikov said, was to allow air spaces between the explosive charges in the hole, and then to blast all holes simultaneously. Although many in the audience were familiar with deck charging, the idea of separating charges of wooden disks and spreaders to obtain air gaps came as a surprise. Queries from the floor were answered by Melnikov, who doesn't speak English, through chalk-talk and via translation from Russian to German to English.

Ultra-technical papers of long-range significance described and evaluated methods, to measure the velocity of explosives, and the stress-strain characteristics of rock produced by explosive forces. Prof. Ichiro Ito and Koichi Sassa, of the department of mining engineering, Kyoto University, Japan, illustrated an expendable piezoelectric pressure gage which measured and recorded detonation pressures within a blast hole. Authors from Armour Research Foundation and Spencer Chemical Co. described underwater blasting techniques used to evaluate the performance of various explosives. T. C. Atchison, S. J. Porter, and W. I. Duvall of the USBM Applied Physics Research Laboratory, showed how explosive performance could be evaluated by placing strain gages in a series of non-shot holes to measure the rock strain and hence the effectiveness of an explosive detonated in blast holes 8- to about 100 ft away from the gage holes.

Other papers covered the current status of jet piercing, pneumatic methods of loading open-pit and underground drill holes, rock mechanics of block caving, methods of prolonging the life of drill steel and tungsten carbide inserts. All papers will be published in book form by the Missouri School of Mines and Metallurgy. Digests of papers will be published in E&MJ and other technical journals.

Back Tax Claims Hit Venezuela Iron Mines

VENEZUELA has collected more than $21-million from Bethlehem Steel's Iron Mines Co. of Venezuela, in claims for back taxes based on alleged under pricing of Venezuelan iron ore. The added taxes sharply boost the government's share of profits from the company's operations from 1951 through 1957 to 67%. The claims are interpreted as an extension and confirmation of the Venezuelan tax policy inaugurated in 1958 which has increased the government's share of oil company profits to 69%. The claims reflect the contention of Minister of Mines and Hydrocarbons Juan Perez Alfonso with respect to both iron ore and oil—that maintenance of prices is a major factor in assuring that countries which produce raw materials for export receive a fair share of profits from the development of their resources. He feels

that companies developing basic mineral resources should be treated as public utilities, and allowed a profit level corresponding to that status. Tax claims are also pending against Orinoco Mining Co., the large U.S. Steel subsidiary, for operations since 1953.

Venezuela is the U.S.'s biggest supplier of imported iron ore—with last year's shipment at 15-million metric tons.

GE Produces First Carat-Size Diamonds

HISTORY'S first large man made diamonds were successfully produced in December by General Electric's research laboratory, according to Dr. Guy Suits, GE's vice president and research director.

The diamonds are over a carat in size, are dark because of structural imperfections, and are not yet of sufficient mechanical strength for industrial application. The GE diamond-making program has advanced steadily since 1955 when the first small artificial diamonds were made. They were about the size of fine grains of sand, an important size for many cutting, grinding and polishing applications, and outperformed natural diamonds in this category. Later, GE succeeded in increasing its control over size, mechanical quality and shape and can now make diamonds up to 1/10 of a carat in size—of excellent industrial quality. The stones are not yet available, however, commercially.

Mine "Mexicanization" Is Officially Enacted

THE MEXICAN GOVERNMENT has recently passed a mining law restricting mining concessions to companies having 51% or more Mexican ownership. The new "Mexicanization" law also stipulates that minerals in national reserves can only be exploited by companies having 66% or more Mexican capital. Sulphur companies in particular felt the sting of the new law in that it now becomes unlawful to pay royalties to persons who gave over concession rights. The Mexican government will have the power, now, to expropriate these royalties. Sulphur companies now pay them to Mexicans and Americans. Also, sulphur exploitation will be subject to an annual quota of production which will be fixed by national patrimony, and by industry and commerce ministries. Concessions will be restricted in area and will last 25 years, with options to extend indefinitely if contracts are fulfilled.

Any new company, or an old foreign company reorganized to comply with the 51% Mexican owned clause would automatically get 50% reductions in export taxes—all going into effect retroactive to Jan. 1, 1961.

(Continued on p 122)

As We Went to Press . . .

The first ingot of copper metal to be both smelted and refined in Southern Rhodesia has been produced at the Alaska smelter of the Messina Rhodesia Smelting and Refining Co. Ltd. Working on concentrates from the Messina group's Jangula mine, the 15,000-tpy capacity smelter is now producing some 40 to 50 tpd.

A renewed plea for tariff protection highlighted the policy declaration approved late last month at the 64th annual meeting of the Colorado Mining Association.

"We advocate tariff protection simply because of the difference in costs between domestic and foreign mining," the declaration said, ". . .With grave doubts, we accepted quotas and, while they have been of some help, they have by no means solved the problem." (See next month's issue for coverage of the meeting.)

A pilot plant will continue tests on autogenous grinding which Cleveland-Cliffs began on low grade ores from the Empire property in Michigan. The new plant, to be constructed at Ishpeming, will apply a Cascade mill to the Empire ores, beginning sometime this summer. Development of the Empire is expected in 1963.

Orange Free State miners are devoting considerable interest to the opening of the intriguing No. 3 shaft area of the Loraine, Anglo-Transvaal's mine in the Odensaalsrus area. The gold mine will combat high temperatures on the 48, 50 and 54 levels by driving twin crosscuts and twin haulageways on all three levels.

Utica Mines Ltd., of British Columbia has taken an option on a fluorspar property in Turkey and the interests of a local firm, Turkwood Mines Ltd. W.C. Ralston, vice president of the B.C. Company, is also investigating mercury sites in Turkey.

Work has begun on a system for sand-filling abandoned stopes and workings at the Bunker Hill mine. Waste rock, previously used for fill, must be removed, and the company is substituting 10-ton skips for the 8-tonners now in use.

Installation of the sand-fill program is expected in early summer.

West Germany, Italy and Yugoslavia, now threatening to compete with Japan for Indian iron ore, may combine forces to negotiate long-term import contracts. Some official discussions have covered the possible construction of a railway connecting Mangalore port with the huge iron ore deposits in Mysore, and development of harbor facilities.

Dr. Stuart Zimmerley and A.E. Back, of Kennecott's Research Center in Salt Lake, have patented a reagent for recovering columbium or tantalum from low grade complex ores. Kennecott has large holdings in the Oka district of Quebec.

The AEC expects major accomplishment in the search for fusion power very shortly, with the ignition of a controlled thermo-nuclear reactor device at Livermore, Calif. The device uses the plasma principle to confine the intense heat generated by the reaction.

WASHINGTON IMPACT

Highlights

CONGRESSIONAL PRESSURE IS MOUNTING on Secretary of Interior Stewart Udall to recommend some new measures to assist domestic mineral and metal production—particularly some help for smaller producers of lead and zinc.

The House Interior Committee plans to start hearings in March on mining legislation, which will require Udall's views and may put him on the spot as to what he plans to do.

Scheduled for hearings are bills to set up subsidies for small lead and zinc producers, and other measures.

Meanwhile, Congressional pressure is also being applied to Udall via the personal route. Rep. Ed Edmondson (D-Okla.), who is sponsoring a small-producer subsidy bill on lead and zinc, recently led a delegation of House members and industry spokesmen to a meeting with Udall.

The Edmondson group also was given some indications that the new Interior Department policy-makers may agree with criticism of the present lead and zinc quota system—that the quotas have done little to improve domestic production.

Meeting with Udall were Edmondson, Reps. Howard Baker (R-Tenn.), Arnold Olsen (D-Mont.), Edgar Chenoweth (R-Colo.), David King (D-Utah), Durward Hall (R-Mo.), Richard Ichord (D-Mo.), Walter McVey (R-Kan.), and Blaine Peterson (D-Utah). In addition, three other House members—including House Interior Committee chairman Wayne Aspinall (D-Colo.)—were represented by staff assistants.

Industry spokesmen who talked with Udall and his staff included Clark Wilson, chairman of the Emergency Lead and Zinc Committee; Tom Kiser, president of Tri-State Lead and Zinc Ore Producers; Ben Guill, representing the smelter group; Robert Palmer of the Colorado Mining Assn., and Emerson Foulke, of Joplin, Mo.

The entourage was about the largest and most forceful of Udall's brief career as Interior chief. The visitors gave detailed reports on unemployment figures, plus the number of mine, mill, and smelter shutdowns in western states.

Although Udall and other Interior officials conceded that conditions were grave and promised to undertake a new review of government policies, they declined to be pinned down on specifics, such as support for Edmondson's legislative proposal.

But the delegation members left saying they were "cheered."

A PROPOSAL for a Government-backed world "cartelization" program to stabilize copper production and prices has been largely discarded by the Kennedy Administration.

Senate majority leader Mike Mansfield (D., Mont.) had urged President Kennedy to lend his weight toward calling an international conference to determine whether some voluntary stabilization arrangement could be worked out for copper.

But a White House aide answered Mansfield and noted that the 1958 London copper conference, sponsored by the United Nations, had concluded that such an international arrangement was not necessary or feasible. Although the White House promised that Government agencies would re-examine policies affecting copper, the implication was that the Kennedy Administration was not, at the moment, interested in such a stabilization program.

Other Government officials report that industry reluctance to take part in such an arrangement, as evidenced in 1958, probably was a factor considered by the White House. Major copper companies generally have been reluctant to enter into agreements for several reasons, including the threat of antitrust prosecution unless proper immunity is obtained, and also the high degree of competition.

In the letter to Kennedy, Mansfield said his proposal stemmed from the repressed price of copper. He said production has been reduced 10% within recent weeks, that the price had fallen to 30¢ per lb, and that the number of miners being laid off in Western states is increasing.

"I have come to the conclusion," Mansfield said, "in view of world conditions, that the only way to face up to the ups and downs which prevail in the copper industry is a cartelization of sorts, agreed to and supported by the copper producing nations of the world."

Administration Will Ask OECD Membership for U.S.

THE SENATE may soon provide an advanced look at the expected 1962 trade policy fight.

President Kennedy and top cabinet officials are asking Senate ratification of U.S. membership in a new, 20-nation Atlantic Community—the Organization for Economic Cooperation and Development.

In hearings before the Senate Foreign Relations Committee, bedrock protectionists criticized OECD as a scheme which would result in a greater flow of imports to the U.S.

Administration spokesmen contend that OECD membership is vital to the U.S. role in world economic affairs; that such a forum is necessary to study, weigh, and argue economic moves among Free World nations to avoid separate routes which could cause suffering by all.

Whether OECD membership could result in new external pressures in U.S. foreign trade policies also is being argued. Protectionists refuse to accept the view of Administration spokesmen that Congress' prerogatives in this area will be safeguarded.

Kelly and Brown Named To Major Mineral Posts

TWO NEW OFFICIALS who will have a voice in Interior Department policies on mineral problems have been named. President Kennedy has appointed John M. Kelly of New Mexico to be Assistant Secretary of Interior for Mineral Resources.

Kelly is expected to be Interior Secretary Udall's top advisor on the Department's mineral programs and will help shape legislative recommendations.

Another new Interior appointee is Charles Stuart Brown of Wyoming, who will be associate solicitor for mineral resources.

Experts Estimate a Drop in 1961 Metal Imports

METAL IMPORTS are due to drop in 1961 below 1960 levels, if preliminary estimates by Government economists are correct. Unofficial guesses put total U.S. imports for this year at about $14-billion, compared with a final $14.6-billion in 1960.

The economists caution, however, that a quick upturn in the U.S. economy could sufficiently revive imports to match or even surpass 1960 levels. But they feel that the upturn probably won't make itself felt until almost mid-year and that second-half imports, although rising, won't make up for the decline in the first six months.

Sen. Bennett Urges New Research on Lead and Zinc

MORE GOVERNMENT RESEARCH on lead and zinc uses is being urged in the Senate.

Sen. Wallace F. Bennett (R-Utah) has introduced legislation designed to authorize speeded research by the Interior Department's Bureau of Mines to find new uses for the metals.

Bennett hopes to get hearings soon before the Senate Interior Committee. The committee last year cleared a similar bill for coal research, which was passed by Congress, signed by the President, and resulted in a new office of coal research in Interior.

Mining Firms May Benefit From Proposed Tax Relief

CONGRESS is expected to give some tax relief this year to mining companies and other businesses. The Kennedy Administration wants business tax relief to increase plant and equipment expenditures and spur the economy. One plan which may be adopted is authored by Stanley Surrey, a former Harvard University professor who has become an Assistant Secretary of the Treasury.

What Surrey favors is a tax credit to be deducted from a company's final tax bill, instead of from its income, for a percentage of funds invested in new plant and equipment in a given year.

A mining company, for example, might have invested $1-million in new plant and equipment in a tax year. In figuring Federal income tax on a regular basis, the company finds that this investment exceeds its amortization allowances by $200,000. If Congress sets the new benefit figure at 25 per cent, the company then would deduct $50,000 from its tax payment.

Sentiment in Congress appears to be turning to the Surrey approach, rather than liberalized depreciation rules and other ideas for tax relief.

U.S. Imports of Soviet Rare Earths Rose in '60

U.S. IMPORTS of precious minerals, ores, and other products from the Soviet Union fell in several categories during 1960, but sizeable quantities of rhodium and ruthenium were shipped to the U.S. for the first time since Soviet trade has been restricted.

Import totals reported by the Commerce Department for the first nine months of 1960 included pig iron, $57,000; chrome ore, $151,000; platinum, $2.4-million; palladium, $1.4-million; rhodium, $1.2-million; and ruthenium, $91,000. Rhodium and ruthenium were not imported from the USSR in the 1947-1959 period.

Labor This Month

UNION ORGANIZING CHECKED: AFL-CIO leaders have had their worst fears confirmed about the sad state of labor organizing. A private survey by the big labor federation's director of organizing, John W. Livingston, reveals a continuing decline in the level of union membership compared with the total work force. Out of a potential 46-million workers eligible for union membership, only 38% are signed up. This is a drop from 40% seven years ago. In the last two years the percentage has declined another 1%. Union membership, actually, has held about even in recent years, but no new members have been added to the union rolls despite the growth of the work force.

Here are some Livingston specifics:

Independent unions outside the AFL-CIO camp have better organizing records than its own affiliates. Particularly, the AFL-CIO expelled Teamsters Union and United Mine Workers' "catch-all" District 50 have outscored the AFL-CIO in winning new members.

Jurisdictional rivalries between AFL-CIO unions are nullifying drives for new members. Under the AFL-CIO system, rival unions are barred from carving out new union territories until they can be mutually agreed on by the interested unions. So far, no broad agreements have been forthcoming.

PINPOINTING THE UNEMPLOYED: New labor plans are in the works to dramatize the high unemployment rate. Instead of a national unemployment conference—which AFL-CIO leaders held at the height of the 1958 recession—the strategy is to hold regional rallies of jobless union members throughout the country. Designed by United Auto Workers' chief Walter Reuther, the program calls for public rallies of union, government and civic leaders in specific pockets of unemployment—among auto workers in Detroit, steelworkers in Pittsburgh, mine workers in Pennsylvania and so on.

Selection of the cities is still being worked out. Though the Mine-Mill and Smelter Workers, an independent union, is not in on the planning, officials of the nonferrous mine union are hoping their Western areas will be included. Mine-Mill territory was ignored in Labor Secretary Arthur Goldberg's first on-the-spot investigation of unemployment last month and the union is hoping for public attention to its own jobless troubles. MMSW leaders warn that unless the current recession is checked in 1961, unemployment in copper and related industries will hit the 15,000 mark.

A LEGISLATIVE BATTLE PLAN: The Kennedy Administration is being prodded by leaders of organized labor to come up with bolder anti-recession programs in Congress. George Meany, AFL-CIO president and his associates complain the new Administration is falling far short in its approach; that its demands for higher unemployment compensation, higher minimum wage, health care to the aged and other proposals are too tame to do the job. However, there's a tactic behind the needling. This is to provide a counter-thrust to opponents of the liberal legislation so that a compromise can be achieved along the lines Kennedy has drawn up.

The strategy, in effect, is to create a middle ground for the President so that he can point out that he's being pushed from the left and the right—and he sits in the center. In reality, the labor leaders would not be disturbed if the White House proposals go through Congress the way they are drawn up.

POLITICS—NOT A PLAYTHING: This is the substance of a warning by labor political experts who are already stirring up union activity for 1962. Declining to rest on the 1960 Democratic victories, the specialists are designing ways to make labor's political work more effective. Already, the AFL-CIO's committee on political education is stirring up the rank-and-file in regional political conferences across the country. Union leaders, themselves, are being pushed hard. The parent federation is disturbed at what it considers inadequate collections among the membership for political activity. Up to now, each union has had a voluntary quota and many have not met it.

MARKETS

Copper Markets Tighten as Africa Sizzles; Zinc Cutbacks Firm Price; Tin Stronger

THE E&MJ INDEX OF NONFERROUS metal prices dropped from 116.1% of the 1947-49 average in January to 115.2% in February. Heavily weighted copper was down about ½c accounting for most of the decline. Zinc, which fell only a fraction of a cent and tin which gained slightly more than ½c, were the only other metals whose prices fluctuated during February.

The E&MJ Index of Metals Use, adjusted for seasonal variation, showed an estimate of 100% of the 1957 average, up 1% from the January preliminary and down 2% from December final 102.

The Congo raging with unrest for many months appeared ready to erupt with the murder in Katanga Province of nationalist Patrice Lumumba. To copper buyers, the loss of 8% of the Free World's output was imminent.

In the Rhodesian Copperbelt, the British government's constitutional proposals have pleased neither nationalists nor White settlers. The Copperbelt produces about 16% of Free World output. Some copper observers are looking as far as 25 years ahead when considering political influence in Africa. In the Congo, where perhaps one out of 100 are literate and tribal influences vary from day to day, an atmosphere conducive to non-interrupted output of copper may be years away. At present, the situation has done nothing more than lend support to an over-supplied market. But in a tight market with every pound needed, Africa's 24-25% share of the world supply could be crucial.

Senator Mike Mansfield's (D-Mont.) proposal for an international copper conference has aroused little interest with either Government or industry officials. It has been pointed out in a letter from the White House to Mansfield that a U.N. sponsored copper meeting in London in 1958 concluded that "governmental action at the international level was not necessary."

Tightness in the world copper market was best indicated by activity on the London Metal Exchange and in the U.S. outside market. London hit £230¼ prompt bid (28.8c) during the month, the highest since December, and was only slightly lower at the close of February. N.Y. merchants late in the month were able to move metal to certain smaller consumers at prices slightly above the producer-smelter quotation of 29c a lb delivered.

General belief is that output cutbacks by nearly every Free World factor and the latent explosiveness of Africa will prevent prices from dipping very far below current levels. However, the tightness of the final week of the past month is not expected to continue. The market has in the past exhibited an ability to discount potential dangers over the long haul and may be expected to do so again when scare buyers build up insurance inventories.

World refined copper stocks rose to a record 436,889 tons in January.

U.S. sales of zinc picked up markedly in the last week of the month. Statistics for January were disappointing—stocks rose 15,000 tons to 206,372, the highest since last July, and production with Bunker Hill and N.J. Zinc back on the firing line was the highest since May.

The industry was quick to take action to protect its price. American Zinc led off by cutting output of metallic zinc by 10% (1,200 tpm). St. Joe Lead followed, slashing output of metal and oxide 15% or approximately 1,800 tpm. The company followed up later in the month with a 15% curtailment of its concentrate production at its mining and milling operation in northern N.Y. Finally N.J. Zinc announced a cutback of 15% of slab zinc and Zamak alloy. Curtailments, low inventories and the low price level had encouraged buyers to come forward as the month ended.

U.S. lead data issued by the American Bureau of Metal Statistics on March 2 showed output at its highest level since May 1958. Domestic shipments were improved and were the best since February 1960, but the added output jumped stocks 10,000 tons to 170,761, the greatest since May 1959.

Sales for the final week of February were nearly 19,000 tons, the best in 14 months. The final flurry enabled February sales to about equal longer January. The 11c N.Y. price was considered steady at the end of the month. At this writing, industry statistics had yet to be discussed, but previous to their issuance, cutbacks had neither been announced nor predicted. Lead buying has been of a pattern, with purchasers holding off until the last minute to cover for the next month. The depressed U.S. economy and abundance of world stocks have regularly given promise of lower prices.

Congressional hearings to consider legislation that would subsidize small producers of lead and zinc will be held on March 8-9. Last session, Congress passed a bill that would have supported zinc at 17c a lb and lead at 14½c.

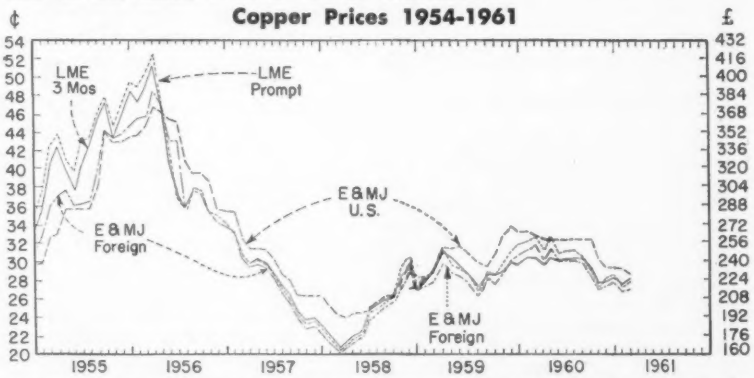
The Lead-Zinc Study Group was to meet early in March in Mexico City to discuss world surpluses.

Primary aluminum output in January was 161,427, down from 165,504 tons in December, at an operating capacity of 77%. Final 1960 statistics showed stocks continuing their record ascent, this time 2,000 higher to 259,511 tons of primary metal. Shipments for the year were 1,866,250 tons down 6% from 1959. In 1959 output trailed demand by about 35,000 tons; in 1960 the reverse was so with production 150,000 tons ahead. Output in 1960 was 2,014,497 tons.

A hot-rolling mill announced in October by Aluminium Ltd., Bridgeport Brass Co., Cerro de Pasco and Scoville Manufacturing will be built near Oswego, N.Y. Construction of the mill, which will have a capacity of 100,000 tpy, will begin in the next few months.

Both the U.S. and Canada are awaiting word from the U.S. State Department on its decision concerning the primary aluminum tariff. The Government must consider idle U.S. capacity and unemployment as well as its position in recent history as an advocate of free trade. There are three possibilities: the Government may keep primary aluminum on the bargaining list without intention of dealing; remove it from the list; or decide to bargain the 1¼c tariff.

N.Y. tin prices reached four-month highs in February, sparked by heavy buying by U.S. tinplaters, strong demand from Japan and reports of lost output in the Congo. The Inter-American Development Bank has approved a loan to Bolivia to improve ore benefication. The Bolivians are reported still considering a Russian offer to build the country's first smelter.



Monthly averages. E&MJ weighted averages are computed from actual reports of sales to E&MJ—normally 140,000 to 17,000 tons per month. LME prices are the average of the mean of the bid and asked; they refer to long tons. The two scales are equal at an exchange rate of $2.80 per £. £320 is 40¢ a lb, etc. Data through Feb. 1961.

Average Prices February (E&MJ Quotations)

Cents per lb unless otherwise indicated:	
Copper:	
Electro, domestic refinery	28.600
Electrolytic, exports refinery	27.040
Electrolytic, c.i.f. Cont'l ports	27.985
Lead:	
Common, New York	11.000
Common, St. Louis	10.800
Silver:	
Silver, New York, per oz.	91.375
Silver, London, pence per oz.	79.625d
Zinc:	
Prime, Western, East St. Louis	11.500
Prime, Western, delivered (g)	12.000
Tin:	
New York Straits	101.042
Gold, per oz, U.S. price	$35.000
Sterling, Exchange	279.991
Quicksilver, per flask	$208.056
Antimony, (E&MJ) (d)	32.590
Antimony, bulk, Laredo	29.000
Antimony, in cases, Laredo	29.500
Antimony for. 99% (h)	25.125
Palladium, troy oz	$24.000
Platinum, refined, per oz	$82.000
Cadmium (a)	150.000
Cadmium (b)	160.000
Al, 99½% unalloyed ingot	26.000
export, ingot	23.250
Magnesium, ingot	35.250
Nickel, (f)	74.000
Bismuth	$2.250
Cobalt	$1.500

Domestic quotations, unless otherwise stated are in cents per lb. Sterling exchange checks, in cents. Quick-silver per flask of 76 lb.
(a) Per lb delivered, ton lots.
(b) Per lb delivered, small lots.
(d) Domestic 5 tons or more but less than carload lots, packed in case f.o.b. New York.
(f) Contract price, f.o.b. Port Colborne U.S. duty included.
(g) Delivered where freight exceeds 0.5c.
(h) 3c duty extra.

Free Gold Markets

The volume of international gold dealings declined 32% in February. Coin and bar prices were lower in most major trading centers, led by London where quotations fell 1¼%. Gold futures were in lesser demand at month's end, with average dealings of $100,000 daily, down from the previous $500,000 level earlier in the month. Carrying charges eased from 4¾% p.a. to 4% p.a. in London and 3⅝% p.a. in Zurich. American gold losses declined only $60-million to $17.37-billion. PICK'S WORLD CURRENCY REPORT quotes on "free gold" per fine oz as follows:

	Coins		Bars (12.5 kg)	
	Jan. 31	Feb. 28	Jan. 31	Feb. 28
New York transit			$35.50	$35.10
Manila	$41.85	$41.25	37.10	36.00
Hong Kong	48.25	48.30	41.15	40.25
Bombay	58.75	57.00	57.50	53.00
Beirut	41.35	40.50	35.79	35.32
Paris	42.50	40.50	36.10	35.35
Buenos Aires	42.30	41.70	36.50	36.10

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

Custom Smelter Copper

Based on flat price and E&MJ average price sales in U.S. for month of February reported by American Smelting & Refining Co. electrolytic copper in standard shapes, adjusted to nearest ⅛¢; ¼¢ deducted for selling common.

Delivered consumer's plant	28.750 lb
F.o.b. refinery	28.350 lb

Major Metals

U.S. DAILY AND AVERAGE PRICES

Cents per lb unless otherwise indicated:

Feb. 1961	Electrolytic Copper (a) Domestic	(b) Export	Europe c.i.f. (e)	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum Primary Pig 99%	Straits Tin New York
1	28.600	26.500	27.445	11.000	10.800	12.000	11.500	26.000	100.250
2	28.600	26.475	27.420	11.000	10.800	12.000	11.500	26.000	100.375
3	28.600	26.625	27.570	11.000	10.800	12.000	11.500	26.000	100.500
6	28.600	26.650	27.595	11.000	10.800	12.000	11.500	26.000	100.500
7	28.600	26.775	27.720	11.000	10.800	12.000	11.500	26.000	100.500
8	28.600	26.750	27.695	11.000	10.800	12.000	11.500	26.000	100.375
9	28.600	26.575	27.520	11.000	10.800	12.000	11.500	26.000	100.375
10	28.600	26.600	27.545	11.000	10.800	12.000	11.500	26.000	100.500
13	Holiday	26.725	27.670	Holiday					
14	28.600	26.975	27.920	11.000	10.800	12.000	11.500	26.000	100.875
15	28.600	27.100	28.045	11.000	10.800	12.000	11.500	26.000	100.750
16	28.600	26.825	27.770	11.000	10.800	12.000	11.500	26.000	101.000
17	28.600	27.200	28.145	11.000	10.800	12.000	11.500	26.000	101.125
20	28.600	27.300	28.245	11.000	10.800	12.000	11.500	26.000	101.375
21	28.600	27.475	28.420	11.000	10.800	12.000	11.500	26.000	101.625
22	Holiday	27.525	28.210	Holiday					
23	28.600	27.550	28.495	11.000	10.800	12.000	11.500	26.000	102.375
24	28.600	27.600	28.545	11.000	10.800	12.000	11.500	26.000	102.125
27	28.600	27.850	28.795	11.000	10.800	12.000	11.500	26.000	102.250
28	28.600	27.725	28.670	11.000	10.800	12.000	11.500	26.000	101.875
AVERAGES FOR MONTH									
Feb.	28.600	27.040	27.985	11.000	10.800	12.000	11.500	26.000	101.042
AVERAGES FOR WEEK									
Feb.									
1	28.600	26.515	27.460	11.000	10.800	12.000	11.500	26.000	100.350
8	28.600	26.655	27.600	11.000	10.800	12.000	11.500	26.000	100.450
15	28.600	26.795	27.740	11.000	10.800	12.000	11.500	26.000	100.625
22	28.600	27.265	28.210	11.000	10.800	12.000	11.500	26.000	101.281
CALENDAR WEEK AVERAGES									
Feb.									
3	28.600	26.550	27.495	11.000	10.800	12.000	11.500	26.000	100.325
10	28.600	26.670	27.615	11.000	10.800	12.000	11.500	26.000	100.450
17	28.600	26.965	27.910	11.000	10.800	12.000	11.500	26.000	100.938
24	28.600	27.490	28.435	11.000	10.800	12.000	11.500	26.000	101.875

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Feb. 1961	Silver (c) New York	Silver London	Sterling Exchange	Gold (d) London
1	91.375	79.625d.	280.3975	252s. 3d.
2	91.375	79.625d.	280.4360	252s. 0d.
3	91.375	79.625d.	280.2460	251s. 9d.
6	91.375	79.625d.	280.0460	251s. 5d.
7	91.375	79.625d.	280.1660	251s. 3d.
8	91.375	79.625d.	280.2380	251s. 4d.
9	91.375	79.625d.	280.1800	251s. 2d.
10	91.375	79.625d.	280.1760	251s. 0d.
13	Holiday	79.625d.	Holiday	251s. 0d.
14	91.375	79.625d.	280.0680	251s. 0d.
15	91.375	79.625d.	279.9340	251s. 1d.
16	91.375	79.625d.	279.9280	251s. 1d.
17	91.375	79.625d.	279.9400	250s. 11d.
20	91.375	79.625d.	279.8860	250s. 11d.
21	91.375	79.625d.	279.7960	251s. 0d.
22	Holiday	79.625d.	Holiday	250s. 11d.
23	91.375	79.625d.	279.7120	250s. 8d.
24	91.375	79.625d.	279.6560	250s. 10d.
27	91.375	79.625d.	279.5080	251s. 0d.
28	91.375	79.625d.	279.5160	251s. 0d.
AVERAGES FOR MONTH				
Feb.	91.375	79.625d.	279.991	—
AVERAGES FOR WEEK				
Feb.				
1	91.375	—	280.502	—
8	91.375	—	280.226	—
15	91.375	—	280.090	—
22	91.375	—	279.888	—

Calendar Week Averages: New York Silver: Feb. 3 91.375; Feb. 10, 91.375; Feb. 17, 91.375; Feb. 22, 91.375.

THE above quotations for major nonferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered U.S. basis add 0.400c per pound, the average differential for delivery charges.

(b) Export copper daily quotations are weighted averages based on sales outside the U.S. reported to E&MJ. Ocean freight and 0.125c lighterage and handling are deducted to arrive at the f.o.b. Atlantic seaboard refinery quotation. On f.a.s. U.S. sales lighterage of 0.125c is deducted.

(c) The daily silver quotations reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually 0.250c below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5c per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price is $35. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

(e) The c.i.f. Continental ports quotation is arrived at by adding to the f.o.b. export quotation lighterage, and the standard conference freight and insurance, Atlantic ports to main Continental ports. Currently this is 0.125c and 0.82c.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West and West effective Apr. 1, 1960, commanded a premium of 1.50c per pound over the current market for Prime Western; Special High Grade 1.75c effective Apr. 1, 1960.

(f) Prime Western delivered where freight from E. St. Louis exceeds 0.500c.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points (almost all U.S. lead is corroding grade).

MARKETS *(Continued)*

London Metal Exchange Quotations

Feb. 1961	Copper Cash Bid	Copper Cash Asked	Copper 3 Mon. Bid	Copper 3 Mon. Asked	Lead Current Month Bid	Lead Current Month Asked	Lead 3 Mon. Bid	Lead 3 Mon. Asked	Zinc Current Month Bid	Zinc Current Month Asked	Zinc 3 Mon. Bid	Zinc 3 Mon. Asked	Tin Cash Bid	Tin Cash Asked	Tin 3 Mon. Bid	Tin 3 Mon. Asked
1	217¾	217½	218½	218¾	64	64⅛	65	65⅛	79⅜	79¼	79	79⅛	784½	785	788½	789
2	218½	218¾	220	220½	64⅛	64¼	65¼	65⅜	79⅜	79¼	79	79⅛	786	786½	789½	790
3	219¼	219½	220½	220¾	64¼	64⅜	65⅜	65¾	79¼	79⅜	79	79¼	787½	788	789½	790
6	221¼	221½	222¼	222½	64¼	64½	65½	65⅝	79½	79¾	79½	79¾	786	786½	788½	789
7	221¼	221½	223	223¼	64⅜	65	65⅞	66	80⅜	81	80⅜	80½	787½	788	790	790½
8	220½	220¾	222½	222¾	64¾	65	65⅞	66	81½	81¾	80½	80¾	787½	788	790½	791
9	218¼	218¾	220¾	221	64⅝	64⅞	65⅞	66	81⅝	81¾	80¾	80⅞	787	787½	790	790½
10	220¾	221	222¾	223	64⅞	65	66⅛	66¼	82½	82¾	81½	81¾	786½	787	790	791
13	223¼	223½	224¾	225	65⅛	65¼	66½	66⅝	83¾	83⅞	82¾	82⅞	787	787½	790½	791
14	223	223¼	224¼	224½	65¾	66	66¾	67	83¾	84	82¾	83	790	790½	793½	794
15	224	224¼	225¼	225½	66¼	66½	67¼	67½	83¾	83⅞	83	83½	791	791½	794½	795
16	224¼	224½	225	225½	66½	66¾	67⅜	67½	84¼	84½	83½	83⅝	793	793½	796	796½
17	223½	224	224½	224¾	66⅜	67	67½	67⅝	84	84¼	83½	83¼	794	794½	796½	797
20	226	226½	226¼	226½	66⅜	67	67⅝	67½	84	84¼	83¼	83½	797	797½	799½	800
21	226½	226¾	226½	226¾	66⅞	67	67½	67⅝	84½	84¾	83½	83⅝	797	797½	799½	800
22	227¾	228	227¾	228	66½	66⅝	67¾	67⅞	84¾	85	83⅝	83¾	801½	802	803½	804
23	227½	227¾	227½	227¾	64¾	64¼	65¼	65⅜	84	84¼	83	83¼	801	801½	803½	804½
24	229	229¼	228¾	229	64¾	64¾	65½	65¾	84⅝	84¾	83¼	83½	802½	803	804½	805
27	230¼	230¾	230¼	230½	65¼	65½	66	66½	84½	84⅝	83¼	83⅝	804½	805	805½	806
28	227¼	227½	227¼	227½	64⅝	64⅝	65¼	65⅜	84	84¼	82⅞	83	800½	801	802	802½
Av'g's	£223.619		£224.550		£65.334		£66.300		£82.763		£81.966		£792.825		£795.550	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.0%, zinc 98% and tin min. 99.7%.

Correction: LME tin for Jan. 12, 3-mon. was £783 bid, £783½ asked. The 3-mon. January average was £786.524.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments, f.o.b. New York unless otherwise stated, tons of 2,000 lb unless otherwise noted. st—short ton; lt—long ton; stu—short ton unit; ltu—long ton unit. (p) duty extra.

MISCELLANEOUS METALS

Feb. 28, 1961

Aluminum ingot, 99.9% lb		28c
Antimony, spot, lb. less than carload, in cases		32.59c
In bulk, carload lots, f.o.b. Laredo		29.00c
Imported, 10 ton min. (p), 99% Duty not paid	25c —	25.25c
Bismuth, ton lots, lb		$2.25
Cadmium, ton lots delivered, lb		$1.50
small lots		$1.60
Calcium, lb, ton lots, 98%, cast		$2.05
Chromium, 99.8% grade, lb, contract delivered	$1.15 —	$1.19
Cobalt, 97 to 99%, per lb effective 3-1-60		$1.50
Germanium, per gram, 10,000 gram lots	(d)28.15c—(c)(d)29.95c	
Indium, troy oz	$1.35 —	$2.25
Lithium, lb, 98%	$9.00 —	$11.00
Nickel, cathodes, lb (a)		74c
Other sales, regular sellers		74c
Sales by dealers, etc		74c
Magnesium, 99.8% carloads, lb producer's plants, Velasco, Texas, effective Apr. 16		35.25c
Palladium, troy oz	$24 —	$26
Platinum, troy oz	$81 —	$85
Quicksilver, flask of 76 lb, 25 flasks or more	$208 —	$211
Selenium, 99 plus %, lb—(Feb. 19, 1958)	$6.50 —	$7.50
Silicon, minimum 98%, carloads, lb		19c
Semi Conductor grade, lb., lump		$360
Tellurium, lb		$4.00
Thallium, 100 lb or more		$7.50
Titanium, 99.3% plus, grade A-1, max. 3% Fe. lb (b)	$1.50 —	$1.60

(a) Effective Dec. 6, 1956; including U. S. duty: (b) Effective Aug. 1, 1959. (c) Delivered; (d) f.o.b. plant.

METALLIC ORES

Beryllium ore, imported, 10% BeO, (b) stu; spot	$32 —	$33
term contracts	$34 —	$34.50
Chrome ore per long ton, f.o.b. cars Atlantic ports, dry:		
44% Cr_2O_3 no ratio	(a)$19.75 —	$20.50
48% Cr_2O_3 3 to 1 ratio	$35¾ —	$38
Iron ore, Lake Superior, Lower Lake ports, lt		
Old Range bessemer		$11.85(e)
Mesabi bessemer		$11 60(e)
Mesabi non bessemer		$11.45(e)
Lead (Galena), 80%, Joplin, Mo., ton		$125.16
Manganese ore—Per ltu of Mn basis 48%, nearby positions, subject to premiums and penalties, c.i.f. U. S. ports import duty extra.,	(n)87c—90c. Long-term contract nominal.	
Molybdenum ore, 90%, per lb of Mo f.o.b. mines		$1.25
Columbium-Tantalum, per lb, combined oxides 10 to 1 ratio	$1.18 —	$1.25
Tungsten ore, per stu of WO_3:		
Foreign 65%, c.i.f. U. S. ports, duty extra	$16.75 —	$17.25
U. S. scheelite, f.o.b. mill	$22 —	$24
Vanadium ore, per lb of contained V_2O_5 f.o.b. mines		31c
Zinc ore, Prime, 60% concentrate, Joplin, Mo., per ton.		$68

(a) Nominal. (b) c.i.f. U. S. ports.
(e) Effective 1958 shipping season.

METALLIC COMPOUNDS

Arsenous oxide (arsenic trioxide) lb, in bbl, carload lots N. Y. docks		4c
Cobalt oxide, 72½% to 73½%, per lb, effective Mar. 1, 1960	$1.15 —	$1.18
Copper sulphate, 100 lb. effective 10-12-60		$12.00
Germanium dioxide, gm		16¾c
Molybdic trioxide, technical, per lb of Mo	$1.46 —	$1.47
Imported, including 37c duty	$1.75 —	$2.05

ALLOYS

Ferrochrome 65 to 70%, per lb of Cr, (4-9% C)		28¾c
Ferromanganese, 74 to 76%, per lb shipping point		11c
Ferromolybdenum, 58 to 64% Mo. lb of Mo contained	$1.50 —	$1.82
Ferrosilicon, 50% per lb of Si f.o.b. shipping point		14.60c
Ferrotungsten, 72 to 82%, lb of W contained		$2.25
Ferrovanadium, per lb of V delivered	$3.20 —	$3.40
Silicomanganese, max., 1½% C, lb contracts		11.6c
Spiegeleisen, per lt. 19-21% grade effective Jan. 22, 1960	$100.00 —	$102.50

NONMETALLIC MINERALS

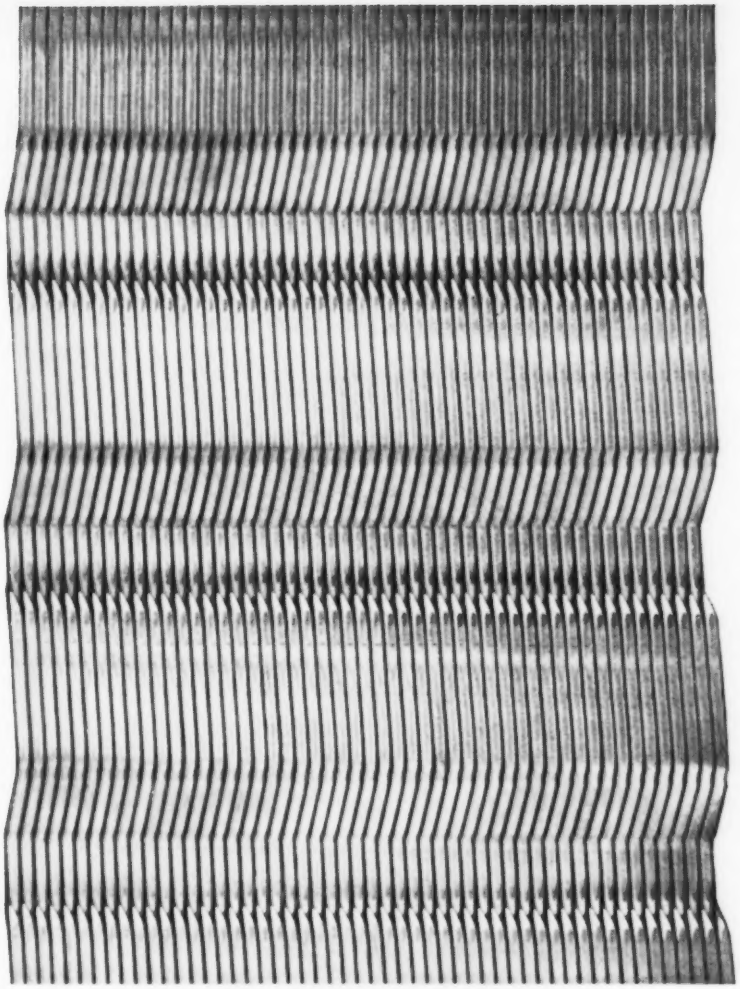
Asbestos, f.o.b. Canada (Quebec) mines (Canadian funds) ton:			
Crude No. 1	$1,400–$1,725	Paper stock	$120–$142
Crude No. 2	$750–$1,155	Waste	$75– $86
Spinning Fibers	$370– $600	Shorts	$40– $75
Shingle fibers	$180– $220		
Asbestos, f.o.b., Vancouver, B. C. (Canadian funds):			
Crude No. 1	$1,522	Spinning fibers	$470–$787
Asbestos, Vermont, f.o.b. Morrisville:		Shingle fibers	$142–$325
Spinning fibers	$353– $408	Waste, stucco or plaster	$86
Shingle stock	$181– $218		
Paper stock	$120– $142	Refuse or shorts	$41– $75

Barytes, f.o.b. cars:		
Georgia, crude, per ton		$18
Missouri, 94%, $BaSO_4$, per st	$16 —	$18
Crude oil well grade, min. 4.3 sp gr, st (a)		$18
Imported, c.i.f. Gulf Ports, st	$16 —	$18
Bauxite, st, f.o.b. point of shipment:		
Imported metallurgical, per lt, f.o.b. Br. Guiana, 60% Al_2O_3, 6% SiO_2, 1.25% Fe, 1-1-60		$7.25
Feldspar, bulk ton; f.o.b. plants:		
Potash or soda feldspar, 200 mesh, ceramic grade	$17 —	$20.50
Glass feldspar, white, 20 mesh		$9
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$37 —	$41
60% effective CaF_2	$33 —	$36
Acid 97% concentrate, bulk, ton		$45.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00 —	$14.00
Magnesite, per ton dead-burned, bulk, f.o b. Washington		$46
Mica—Domestic, f.o.b. mines, Punch 7c-12c per lb according to size and quality. Sheet clear 1½x2 in. 70c-$1.10; 2x2 in $1.10 to $1.60; 2x3 in, $1.60-$2.10; 3x3 in, $1.80-$2.30; 3x4 in, $2.00-$2.60; 3x5 in, $2.60-$3.00; 4x6 in, $2.75-$4.00; 6x8 in, $4.00-$8.00. Wet ground, very fine, $140-$155 per ton, Bulk sales, dry ground; $30-$55 per ton. Scrap $20-$30.		
Ocher Georgia, ton in sacks	$26.50 —	$32.00
Sulphur, Mexican, for use in Mexico, metric ton, f.o.b. mines, depending on location	$21 —	$23
For export f.o.b. vessel, depending on grade	$22.50 —	$23.50
Actual prices received by U. S. producers approximate the Mexican export prices.		
Talc, f.o.b. works, ton:		
New York, purified	$18.00 —	$20.00
Vermont, extra fine		$12.50
Tripoli, Missouri, ton:		
40-mesh, cream colored		$50.00

(a) Some restricted sales at $11.50 (b) Corrected. (c) Nominal.

IRON AND STEEL

Pig iron, gross ton, basic, Valley furnaces		$66.00
Steel, f.o.b. Pittsburgh, billets, net ton		$80.00
Structural shapes, Pa., Ala., etc., 100 lb	$5.30 —	$5.50



STOP

MEDIA WASTAGE

with Hendrick Cascade Wedge Wire Screen

Whether you're screening coal, iron ore or gravel, you can't beat Hendrick Wedge Wire Cascade screens for dewatering efficiency. Cascade's unique "step" construction eliminates flooding caused by overloads... increases the weight of solids processed as well as the amount of water in screen under flow. Wavy wedge wire breaks up the flow layer and causes a tumbling action that permits far greater throughput. As a result you can sharply increase draining capacity and media recovery. Hendrick Cascade screens can be mounted on any equipment presently using profile type screens. They're available with openings from ¼ to 1½ m.m. in stainless steel. Send in the coupon for more information.

HENDRICK Manufacturing Co.
Carbondale, Penna.

Perforated Metal • Perforated Metal Screens • Wedge-Slot Screens
Hendrick Wedge Wire Screens • Architectural Grilles • Mitco Open Steel
Flooring • Shur-Site Treads • Armorgrids • Hendrick Hydro Dehazers

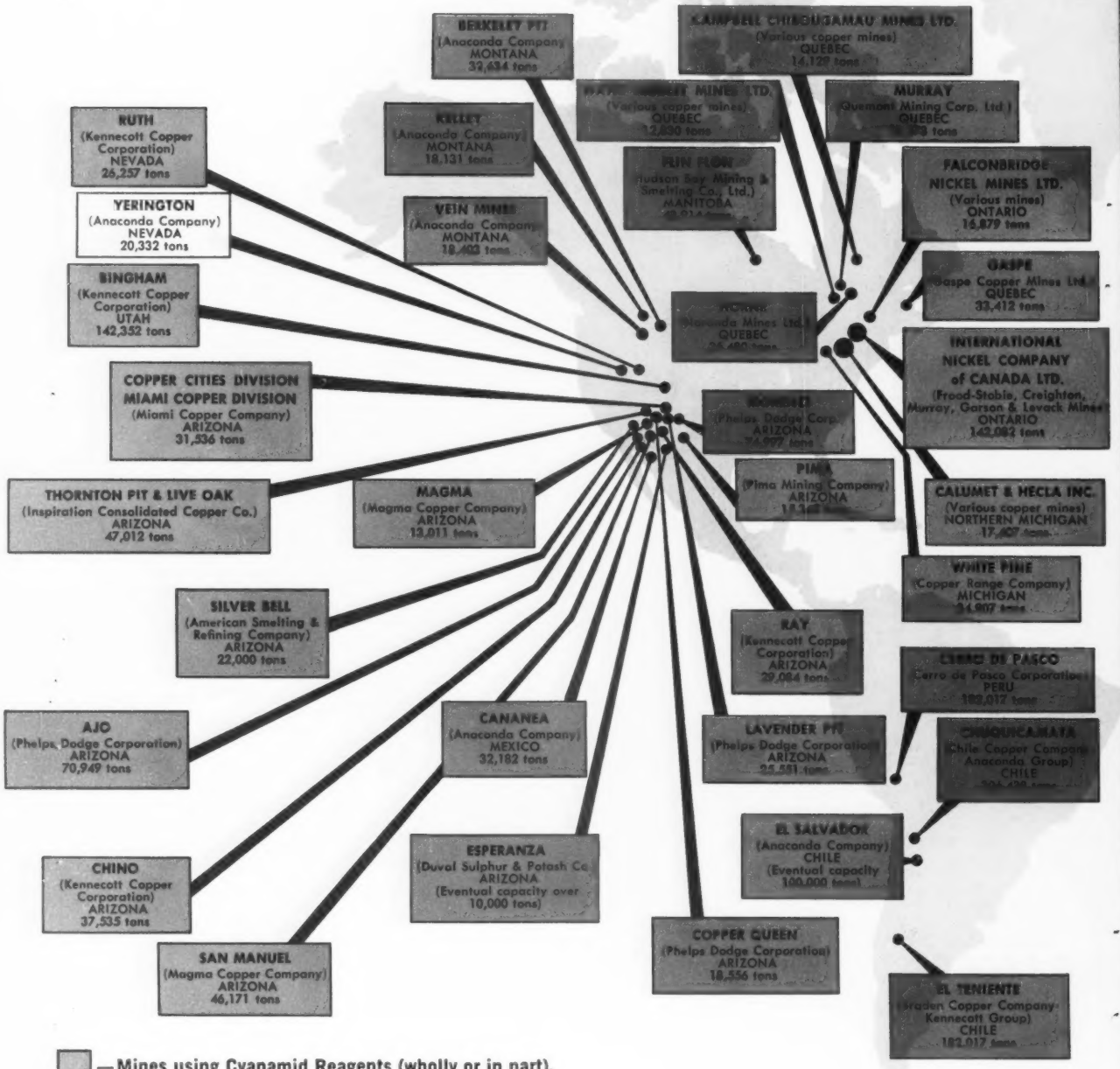
HENDRICK Manufacturing Company
Carbondale, Penna.

Gentlemen: I want more information on Hendrick Cascade Wedge Wire Screen.

☐ Please have representative call.
☐ Please send me FREE literature on Cascade Wedge Wire Screen.

Name_____
Title_____
Company_____
Street_____
City_____ State_____

Where there's Copper...



— Mines using Cyanamid Reagents (wholly or in part).

As the map so clearly indicates, Cyanamid supplies part or all of the reagent requirements for virtually every major copper mining property in the world.

This is true for other ores, too, and the reasons can be summarized in one sentence! Cyanamid offers every mining district dependable delivery of the broadest range of metallurgical chemicals available from a single source plus in-the-mill assistance in their use.

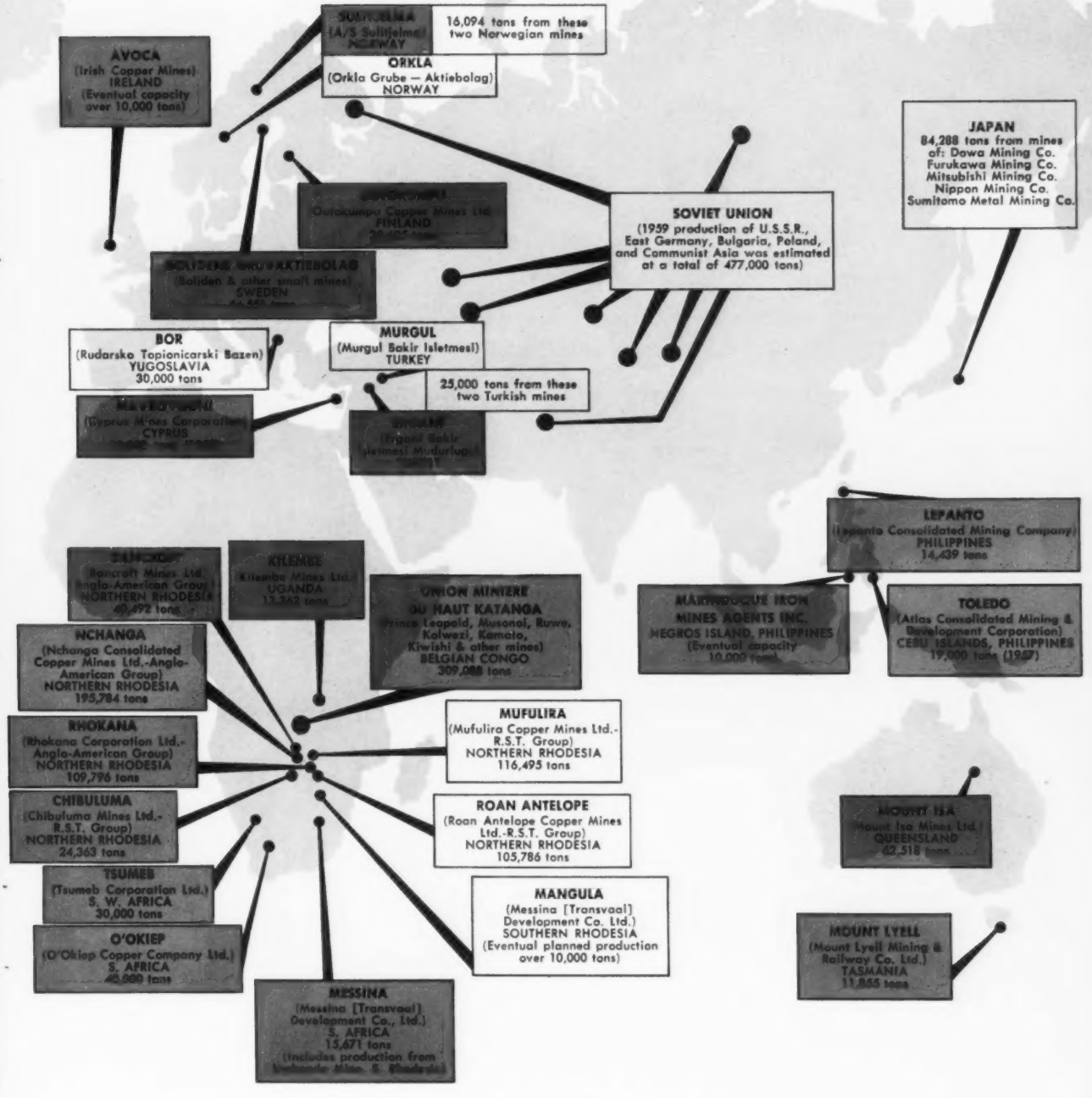
No matter what ore you're treating, a Cyanamid Field Engineer stands ready to help you improve recovery and cut costs by suggesting more efficient reagent combinations. His recommendations are based on a thorough knowledge of up-to-the-minute ore dressing technology around the world.

For prompt assistance on your reagent requirements, get in touch with our nearest office.

1959 mine production of copper metal in short tons (unless otherwise noted)

SOURCES: Company Annual Reports, Year Book of the American Bureau of Metal Statistics, Copper Institute
Year Book of the British Bureau of Metal Statistics, Metallgesellschaft Aktiengesellschaft Metal Statistics

there's a *Cyanamid* Reagent!



CYANAMID

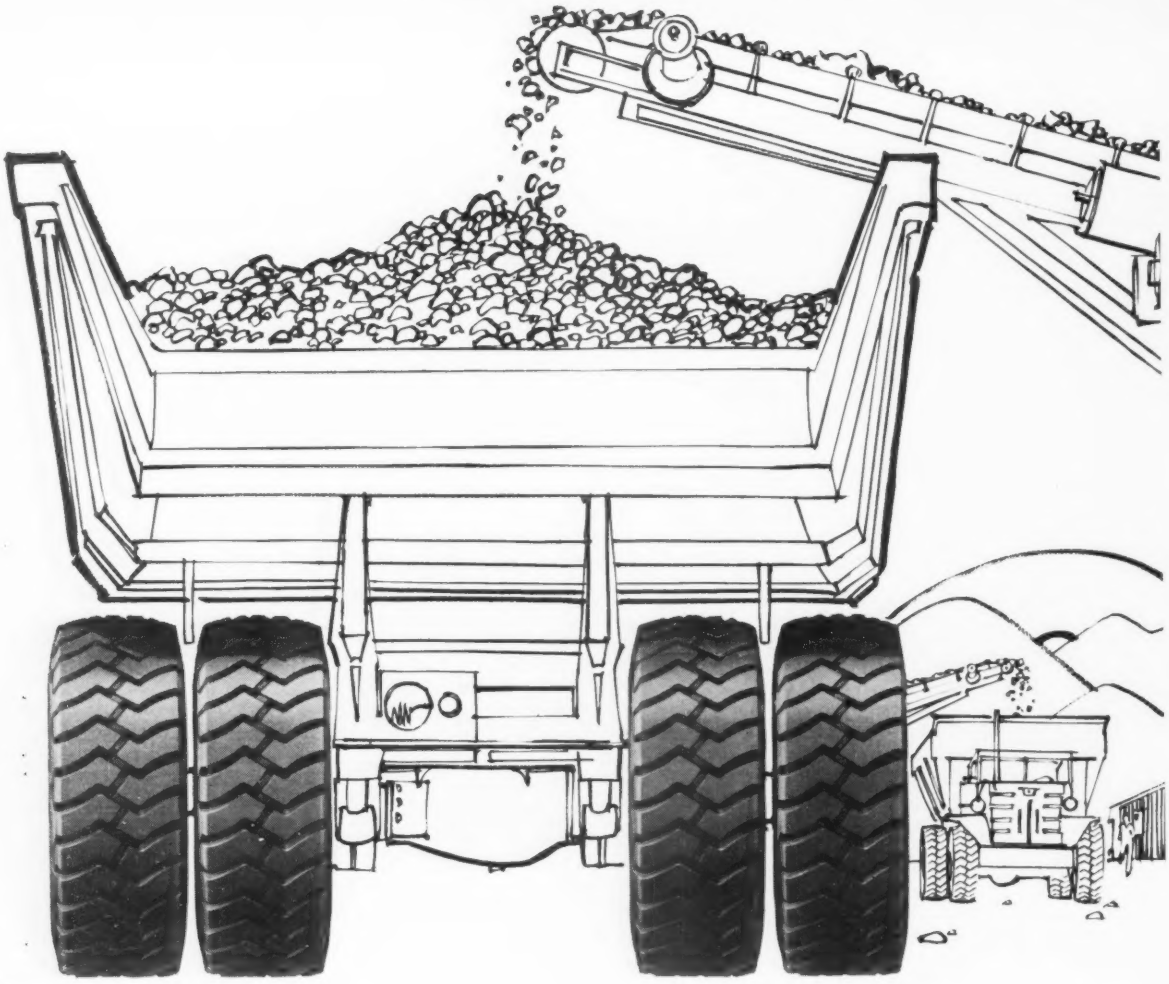
AMERICAN CYANAMID COMPANY

EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

CYANAMID INTERNATIONAL — *Mining Chemicals Department*
Cable Address: — Cyanamid, New York

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

CYANAMID INTER-AMERICAN CORPORATION, *Lima, Peru* • CYANAMID OF CANADA LIMITED, *Montreal, Quebec* • CYANAMID AUSTRALIA PTY. LTD., *Melbourne, Australia*
SOUTH AFRICAN CYANAMID (PTY.) LTD., *Johannesburg, Union of South Africa* • CYANAMID (FAR EAST) LTD., *Yuraku-Cho, Tokyo, Japan*
CYANAMID DE MEXICO, S.A. de C.V., *Mexico 1, D.F., Mexico* • CYANAMID OF GREAT BRITAIN LTD., *London W.C. 2, England*



Shock-Fortified Firestones

KEEP LOADING SCHEDULES ON TIME!

You know how hard quarry hauling can be on tires. To keep your equipment busy, you need tires that can take tough day-in, day-out use. You need tires with staying power—Firestone tires. Firestones match any job, no matter how tough. Firestone Rubber-X, the longest-wearing rubber ever used in Firestone tires, is specially compounded to resist rock and shale cuts. And the Firestone Shock-Fortified Nylon cord body soaks up one wallop after another—and keeps on running. For tires that last longer—and are backed by swift, on-the-job service—see your Firestone Dealer or Store today. **Always Specify Firestone Tires When Ordering New Equipment.**

Tune in Eyewitness to History every Friday evening, CBS Television Network

Firestone

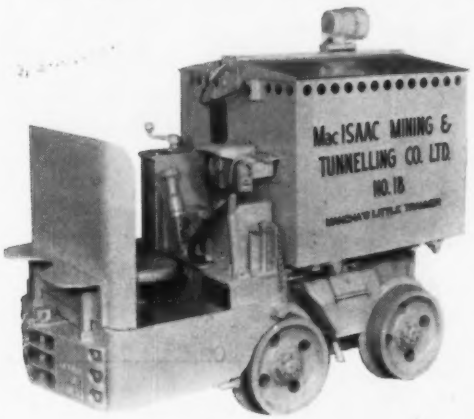
BETTER RUBBER FROM START TO FINISH

Copyright 1961, The Firestone Tire & Rubber Company

36 Years...handling ore, waste, timber, supplies

This may not be the oldest Little Trammer in daily service, but it certainly has been one of the most versatile. For 36 years, it has been used all over a Southwest metal mine . . . underground . . . handling ore, waste, timber and supplies. Temperatures have been as high as 125° with humidity at 90%.

Today's Work Horse . . . *tougher and more dependable than ever*



. . . the reason! A consistent program of product improvement. Now the Little Trammer has glass-wound armatures and field coils which increase ability to withstand high ambient temperatures, heavy continuous service and the use of larger batteries with safety. Lever brake can be quickly and easily applied and has a positive release. Camtactor controller provides trouble-free service. Heavy duty springloaded plugs and receptacles have locking latch handle. Finally, the motorman is protected by a rugged shield.

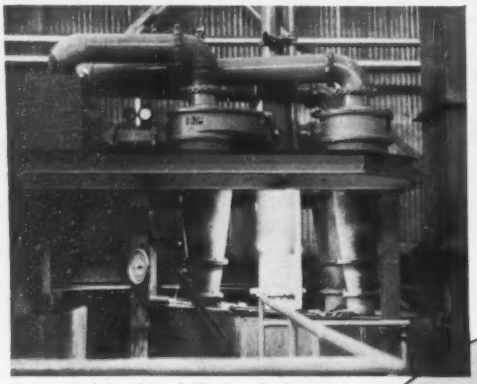
Mancha's Little Trammers are small enough for narrow drifts, are never slowed down by climate, altitude or poor ventilation. They have a record of paying for themselves in a short time . . . they'll do the same for you. Ask for the full story. No obligation.

MANCHA LOCOMOTIVE

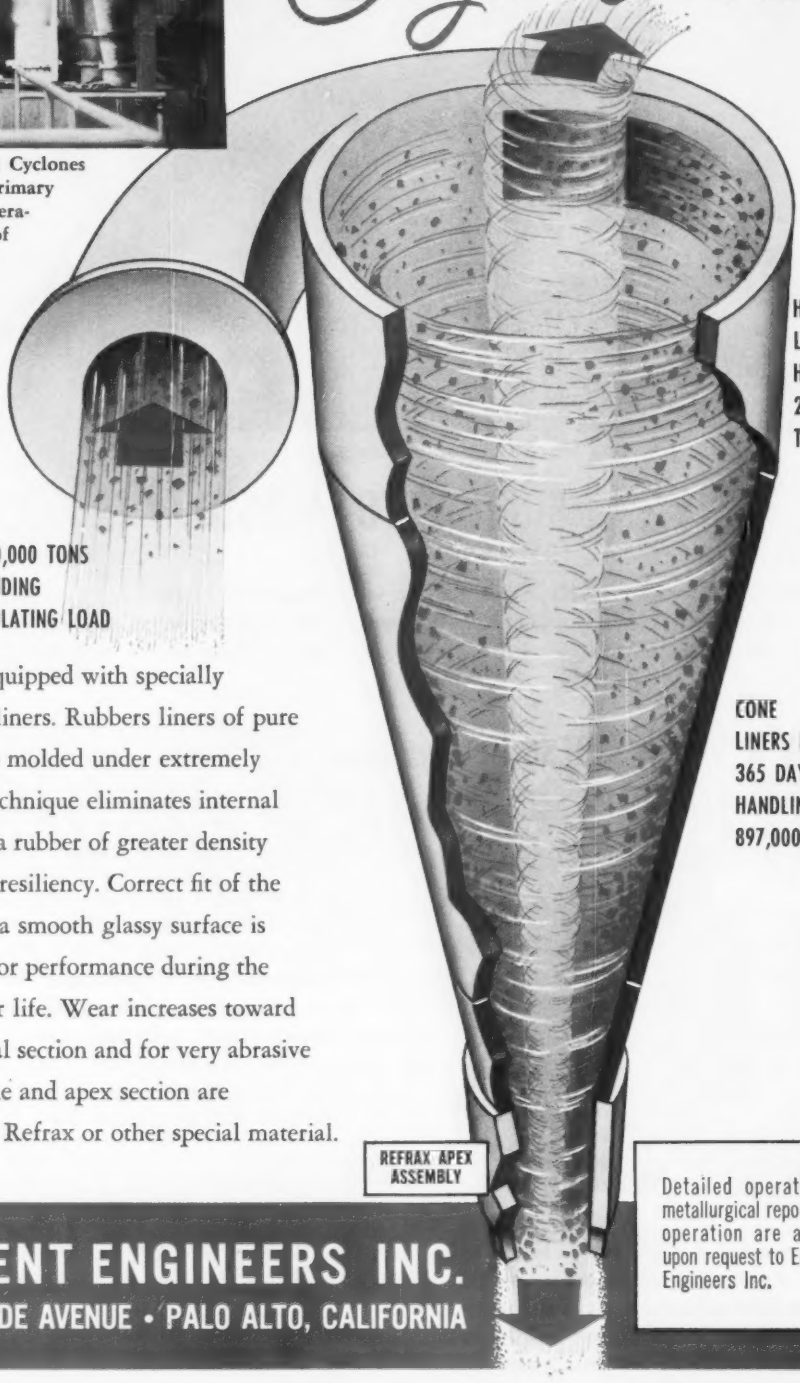
DIVISION GOODMAN MANUFACTURING COMPANY

Halsted Street and 48th Place • Chicago 9, Illinois
Cable Address: Mancha, Chicago
Mancha representatives are located in principal mining areas throughout the world.

Each KREBS CYCLONE handles 2,050,000 tons of primary ball mill discharge with *Original liner!*



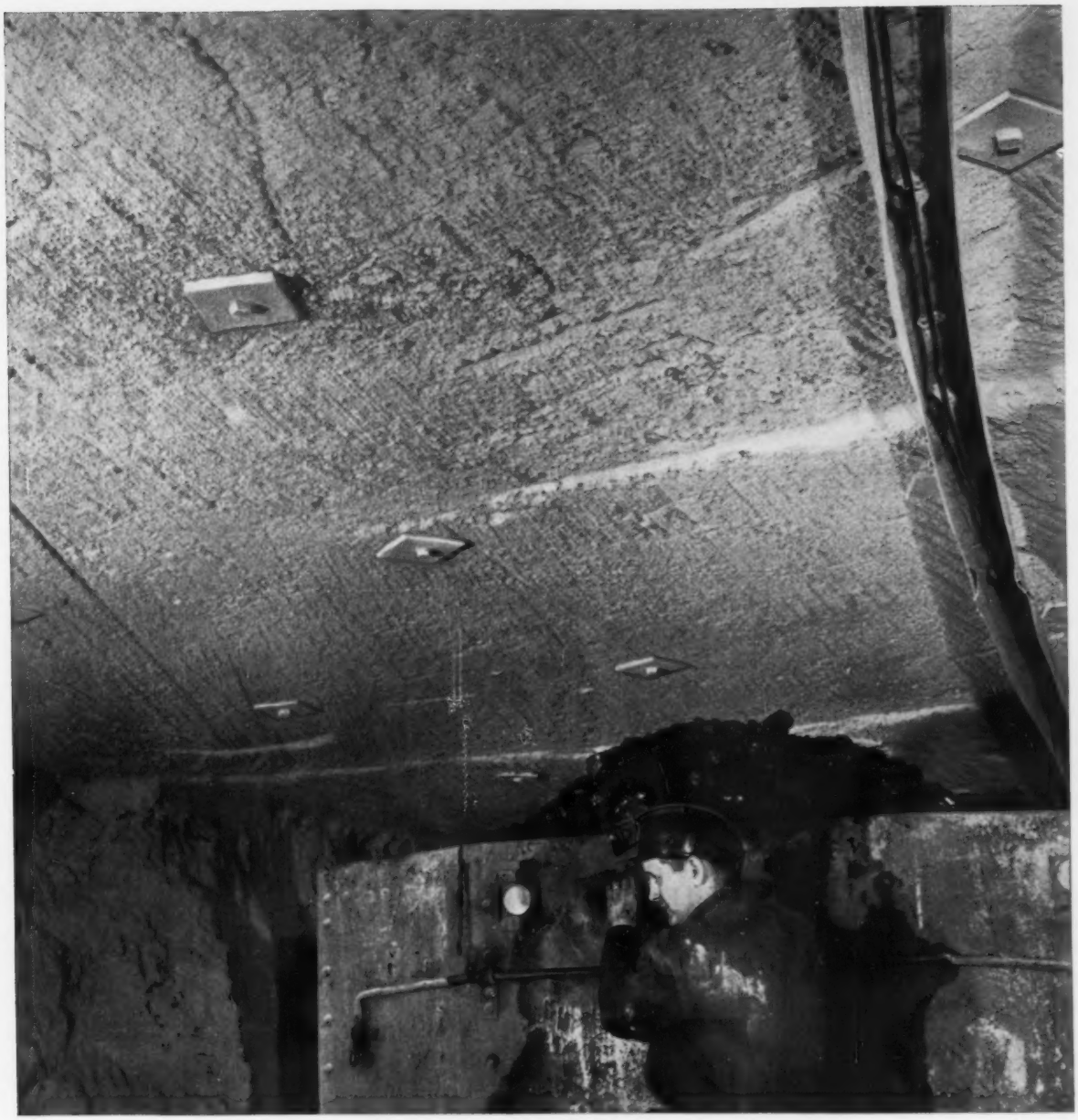
One of 4 banks of Krebs Cyclones (4 in each bank) in primary closed-circuit grinding operation at Silver Bell unit of American Smelting and Refining Company.



Krebs Cyclones are equipped with specially designed replaceable liners. Rubbers liners of pure gum or Neoprene are molded under extremely high pressure. This technique eliminates internal porosity, resulting in a rubber of greater density without reducing the resiliency. Correct fit of the liners is assured, and a smooth glassy surface is maintained for superior performance during the greatly extended wear life. Wear increases toward the apex of the conical section and for very abrasive slurries the lower cone and apex section are frequently lined with Refrax or other special material.

Detailed operating and metallurgical report of this operation are available upon request to Equipment Engineers Inc.

EQUIPMENT ENGINEERS INC.
737 LOMA VERDE AVENUE • PALO ALTO, CALIFORNIA



Bethlehem roof bolts clamp rock strata together to improve the safety in this coal mine.

Keeping the roof safe

The proved way to make your roof sound—and keep roof falls to a minimum—is to install bolts in the correct pattern for local conditions. This includes both stratified and massive rock formations.

Who figures this out? Who works right along side your team during the installation? Who checks back, at specified periods, to test and inspect? Your Bethlehem contact man. He'll come see you. Just tell us where and when.

Steel

for Strength
... Economy
... Versatility

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Save on construction costs with the new '61 FORD TRUCKS

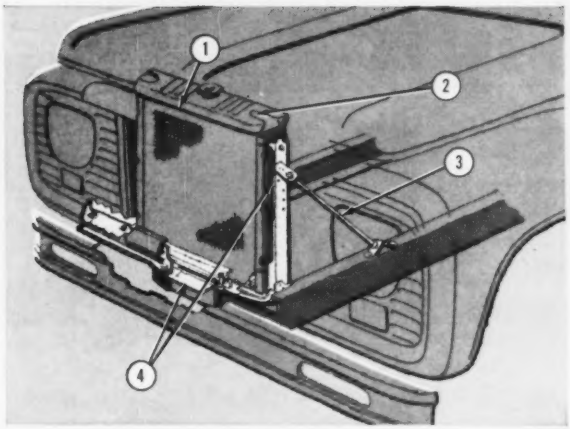
FORD HEAVIES SAVE WITH DOUBLE THE CAB, SHEET METAL AND RADIATOR LIFE

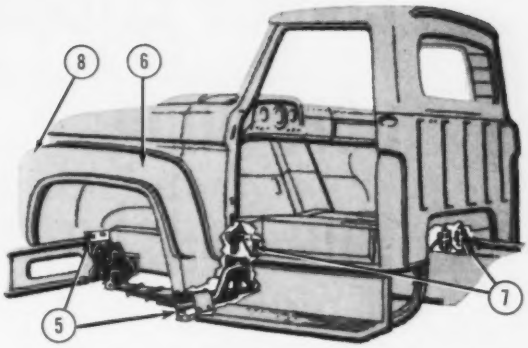
Ford F-Series Heavy Duty models are especially designed for the rugged terrain and tough conditions generally found on construction jobs. Their new independent mounting system for cab and radiator effectively separates both from adjacent sheet metal assemblies for much greater durability. And radius rod-leaf type rear springs provide better axle alignment, a smoother ride and longer spring life.

The electrical wiring system has been improved for greater reliability. Chassis wiring is fastened within the protection of the frame web, away from mud, ice and snow. And Ford Truck frames have been engineered to make the mounting of bodies and special equipment easier. A new 212-inch wheelbase model is available to accommodate extra-long bodies.

Save with Ford T-Series Heavy Duty Tandems for exceptional durability, big payloads and low operating expenses. Ford T-700, T-750 and T-800 Tandems have rugged double-channel frames that are built to take tortuous off-road treatment. And they provide a wider range of chassis options so you can choose the right power train and load-carrying components for any job. Eaton and Timken rear axles are now available in bogie assemblies with 22,000-, 28,000-, 30,000- and 34,000-lb. capacities. And lightweight aluminum walking beams, wheels and gas tanks are available to keep chassis weights low . . . payloads high.

Ask your Ford Dealer about Ford's full tandem line . . . including Super Duties with 38,000-lb. bogies for up to 51,000-lb. GVW!





① **Save with Ford's exclusive "lock-seam" radiator construction** that doubles the solder area at key seams for greatly increased strength and longer radiator life.

② **Save with heavier-gauge metal on radiator tank and header.** Tanks and header have thicker walls to resist vibration, jolts and corrosion for greater reliability.

③ **Save with independent radiator mountings,** separate from front-end sheet metal. This means that road shocks and shakes are not transmitted to the radiator through sheet metal . . . tanks, tubes and connections last longer, require less maintenance.

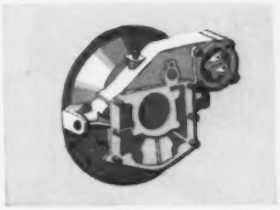
④ **Save with "horse collar" mounting** for extended radiator life. This new mounting on resilient rubber at the center of frame cross member soaks up any frame flexing . . . cuts wear and tear on entire cooling system.

⑤ **Save with independent fender mountings.** Fenders are bolted to a rubber-cushioned transverse bracket at the front and a frame-mounted bracket at the rear. This mounting, independent of both cab and radiator, eliminates stress transfers for increased fender life.

⑥ **Save with removable fenders.** The quick and easy removal of only 8 bolts per fender provides faster service accessibility to the engine area, saving valuable maintenance time.

⑦ **Save with new 3-point cab mounting system** for greater cab durability. Two outboard front mounts plus a centered "twin" rear mount provide a triangular system that holds the cab stationary while allowing the frame to move independently . . . reducing strain on the cab.

⑧ **Save with 25% heavier-gauge sheet metal** in fenders, cab floor pan and toeboard for longer life through more strength and greater resistance to corrosion.



Save with Ford's new Full-Torque flywheel power take-off . . . now available on T-750's and up, to power construction equipment like transit mixers. It's much simpler and more efficient than long, complicated hookups needed with the front-end drives. And the flywheel PTO is lighter in weight—only 105 pounds—for greater payloads.

FORD TRUCKS COST LESS

YOUR FORD DEALER'S "CERTIFIED ECONOMY BOOK" PROVES IT FOR SURE...

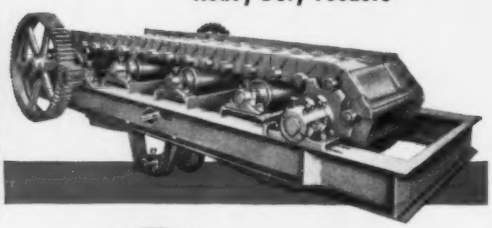
FORD DIVISION, Ford Motor Company

TELSMITH

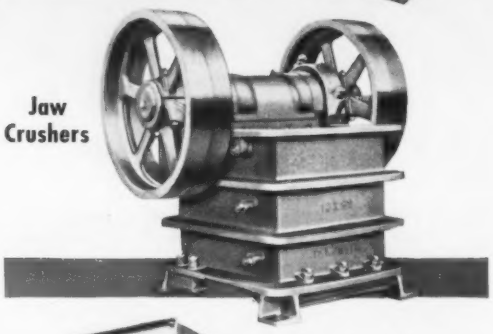
feeding
coarse crushing
screening
fine crushing
scrubbing

EQUIPMENT FOR MINES

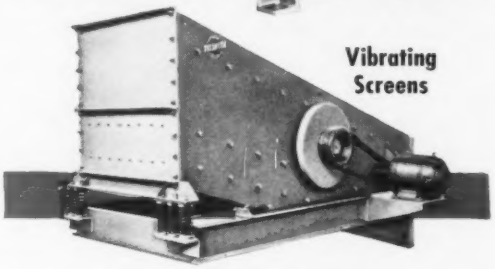
Heavy-Duty Feeders



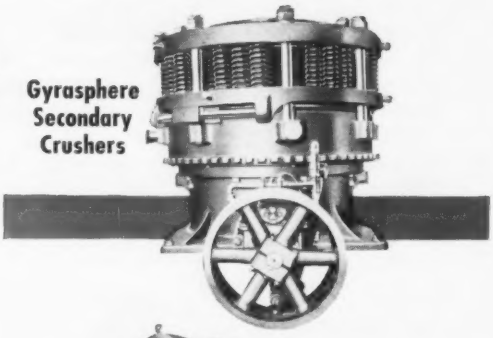
Jaw Crushers

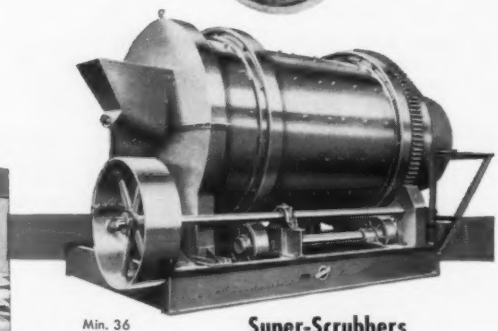


Vibrating Screens



Gyrasphere Secondary Crushers





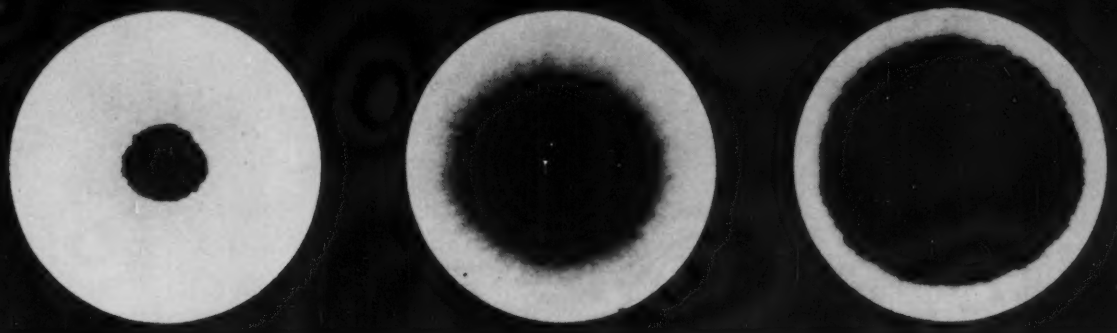
Min. 36

Super-Scrubbers

SMITH ENGINEERING WORKS
502 E. CAPITOL DRIVE, MILWAUKEE 1, WISCONSIN

A DIVISION OF
Barber-Greene
Aurora, Illinois, U.S.A.

Cable Address: Sengworks, Milwaukee • Representatives in Principal Cities in all Parts of the World



3 drops of oil—3 conditions. First oil doesn't spread and has lost dispersancy. Second oil spreads into paper, has good dispersancy. Third spot indicates good dispersancy, but high soot level. Shell "Oilprint" Analysis can give you advance warning of engine trouble.

BULLETIN:

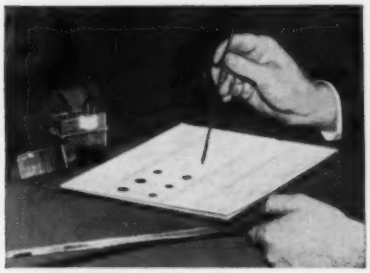
Shell 5-minute "Oilprint" Analysis shows what's going on inside your engines; now used by over 500 fleet operators

Now, with Shell's ADC® "Oilprint" Analysis, you can test used engine oils in your own shop. And in a matter of minutes.

Read how this unique testing process can give you advance warning of engine trouble, help you set up more effective maintenance schedules and reduce roadside breakdowns.

A DROP of oil from an engine is an excellent indicator of the lubricant's condition and—to the experienced eye—of the engine's condition.

It can tell you if the oil is still satisfactory for continued service. It can provide clues to faulty carburetion. It can show a coolant leak. It can help you schedule proper oil drain intervals. And much more.



"Oilprint" Analysis can be made in your own shop.

How do you get this information quickly?

Over 500 fleet operators have found the answer in Shell's 5-minute "Oilprint" Analysis.

All that's needed: Shell's ADC "Oilprint" Analysis Chart and a warmed-up engine.

A few drops tell the story

Take the problem of sludge accumulation.

If the oil makes a dark concentrated spot, it has lost its ability to hold sludge particles in suspension. Poor dispersancy, our technical people call it. The oil should be changed.

By adding Shell Indicator Fluid, a Shell Representative can tell if the oil still has its anti-wear properties. In Shell's Motor Oils for fleet use, these properties guard against engine wear.

You can also determine the relative amount of soot and contaminants—such as wear debris and dust that might foul your engine. If there's a water leak or anti-freeze contamination, proper evaluation of an oilprint will reveal it.

Free Demonstration

Your Shell Industrial Products Representative will gladly give you a free demonstration of the Shell ADC "Oilprint" Analysis. He will show you how to set up a "life cycle" report of every engine you operate. Call him today

SHELL

A BULLETIN FROM SHELL
—where 1,997 scientists are helping to provide better products for industry.

WITH FULL-LOAD PERFORMANCE FULL TIME.....

Planet Power-steered..Hi-Lo outblade clutch-steered

With exclusive "live track" Planet Power-steering, the International TD-25 makes full-load, full-power turns—or slams straight ahead with offset loads—where giant clutch-steered rigs slip and slue. With exclusive Hi-Lo, on-the-go power-shifting, the "25" gives you instant cut-to-fill matching of power to condition. You roll up big loads—and keep 'em rolling. With exclusive International DT-817 engine wallop the "25" bulls along, 230 turbocharged hp strong—without "slow-motion" lug-downs, even at high altitudes! Prove to yourself the planet-drive "25" clobbers all comers—outpushes or outpulls 'em up to 50% —*and with standard equipment.* Let your International Construction Equipment Distributor demonstrate.

Dozing volcanic cinders for railroad ballast, this International TD-25 beats the combined production of two similar-sized clutch steered crawlers on the same job! Reason: Hi-Lo power-shifting gives exclusive 4-speed torque-converter efficiency-range control. The "25" delivers heaped loads every pass! To defy "grinding compound" conditions, the "25" undercarriage has heavy-duty Dura-Rollers.

Even with an enormous offset load of shot rock there's no "bank-nosing," no sluing. The TD-25 operator simply runs the load-side track in high-speed range—the other in low-speed range. Result: full-capacity, straight-ahead performance—which the "25" also gives on benching, bank-cutting, and side-casting! In the same way, you make full-load turns—because Planet Power steering eliminates "dead-track drag!"

With Hi-Lo on-the-go power-shifting you shift down, to dig hard material—shift up, to "run" with the load. And to make full-load turns without spillage, use Planet Power steering: down-shift the turn-side track, and you've got it made! When push-loading with the "25", you maintain solid contact on straight-away or curve—to speed heaping the bowls and get gear-higher "kick-outs"!

power-shifted "25's" crawlers up to 50%!

With the same 2-finger ease as on dozing or push-loading, you steer the TD-25 pulling heaviest drawbar tools. This "25" is deep-ripping "concrete-like" mountain clay that has to be shattered before dozer can move it economically. The "25" has the super undercarriage strength of double-box-beam track frames—for full-capacity performance.

International® *Construction Equipment*

International Harvester Co.,
180 North Michigan Ave., Chicago 1, Illinois
A COMPLETE POWER PACKAGE

"JFI Positive Performance Feeder cuts costs six ways at Wyatt-Seanor Mine."

Says John Harvey, Superintendent, Wyatt-Seanor Mine, Simpson Coal and Chemical Corporation.

Simpson Coal and Chemical increased production *and cut costs* when they installed a JFI *positive performance* Feeder in their Wyatt-Seanor Mine in Western Pennsylvania. John Harvey, Wyatt-Seanor Superintendent, reports: "The JFI Feeder allowed us to more fully utilize belt capacity by conveying more coal at slower belt speeds—100 f/p/m *less* than before. Belt wear was noticeably reduced.

"We were also able to eliminate mainline belt spillage from the feeder point to the outside of our mine, and now there is no need to attend belt transfer points. Many man hours are being put to use at more productive jobs. Elimination of surges and overload conditions has reduced mechanical maintenance on belt drives and cut horsepower requirements on those drives."

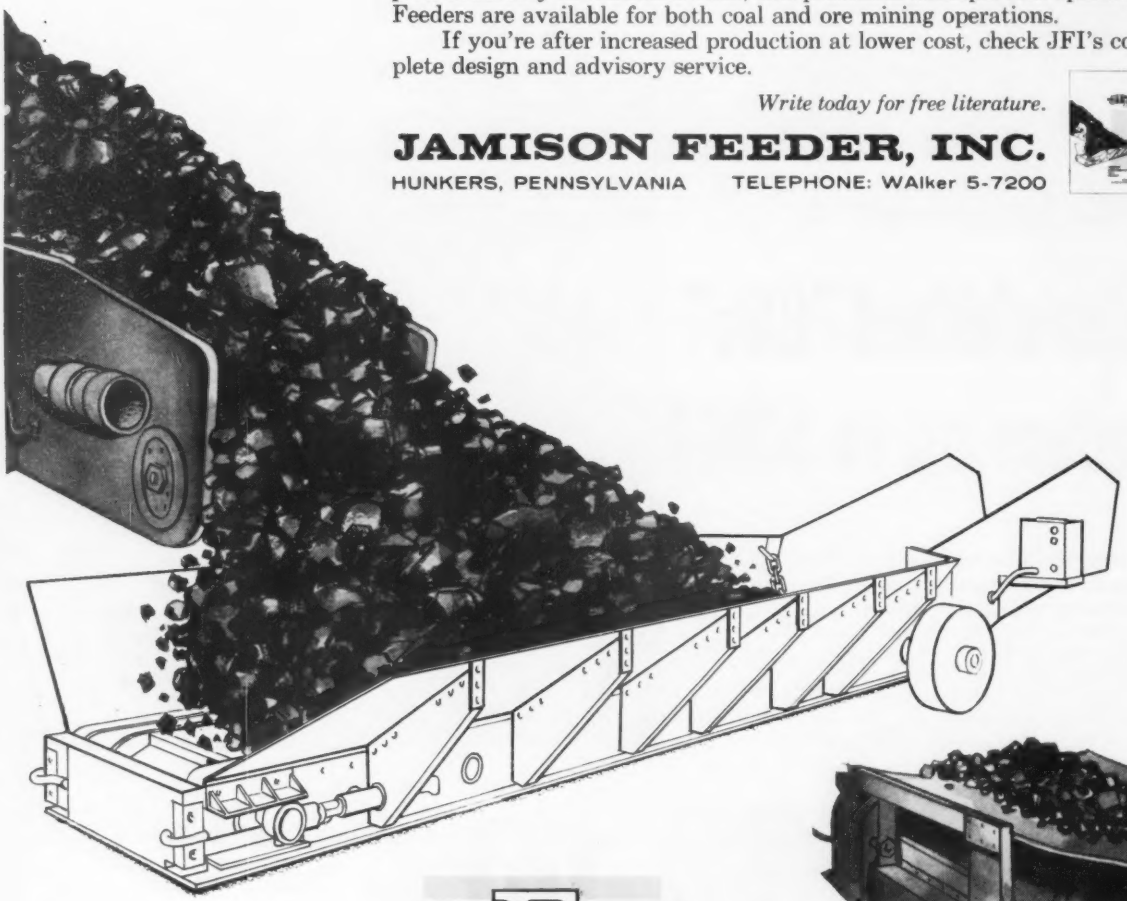
JFI *Positive Performance* allows high shuttle car discharge rate, complete flexibility of reduction ratio, and profitable multiple belt operation. Feeders are available for both coal and ore mining operations.

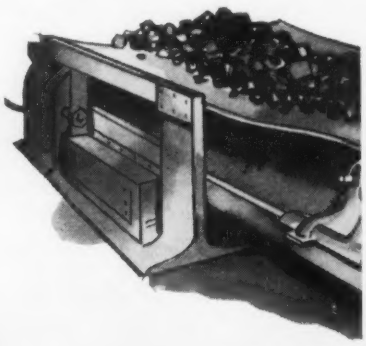
If you're after increased production at lower cost, check JFI's complete design and advisory service.

Write today for free literature.

JAMISON FEEDER, INC.

HUNKERS, PENNSYLVANIA TELEPHONE: WAlker 5-7200





An example of Avisco Rayons in Industry

Now, stronger, lighter-weight belts with Avisco XL-I rayon

Because of fabrics made from Avisco XL-I rayon fiber it is now possible to engineer stronger, lighter-weight belts.

Compared to the traditional fiber, fabrics of XL-I rayon have up to 60% greater tensile strength and 3 to 5 times the fatigue life.

XL-I rayon adheres without predipping. Flex characteristics are excellent. XL-I fabrics trough well, conform better to pulleys and rollers, readily absorb starting and shock loads. Their lighter weight requires less power for starting and running.

For help in improving your product with Avisco XL-I rayon reinforcement, send in the Quick Reply Coupon.

QUICK REPLY COUPON 3-19

Industrial Merchandising Division
American Viscose Corporation
350 Fifth Avenue, New York 1, N. Y.

Please contact me about Avisco Rayons for use in the following application:

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Name_____

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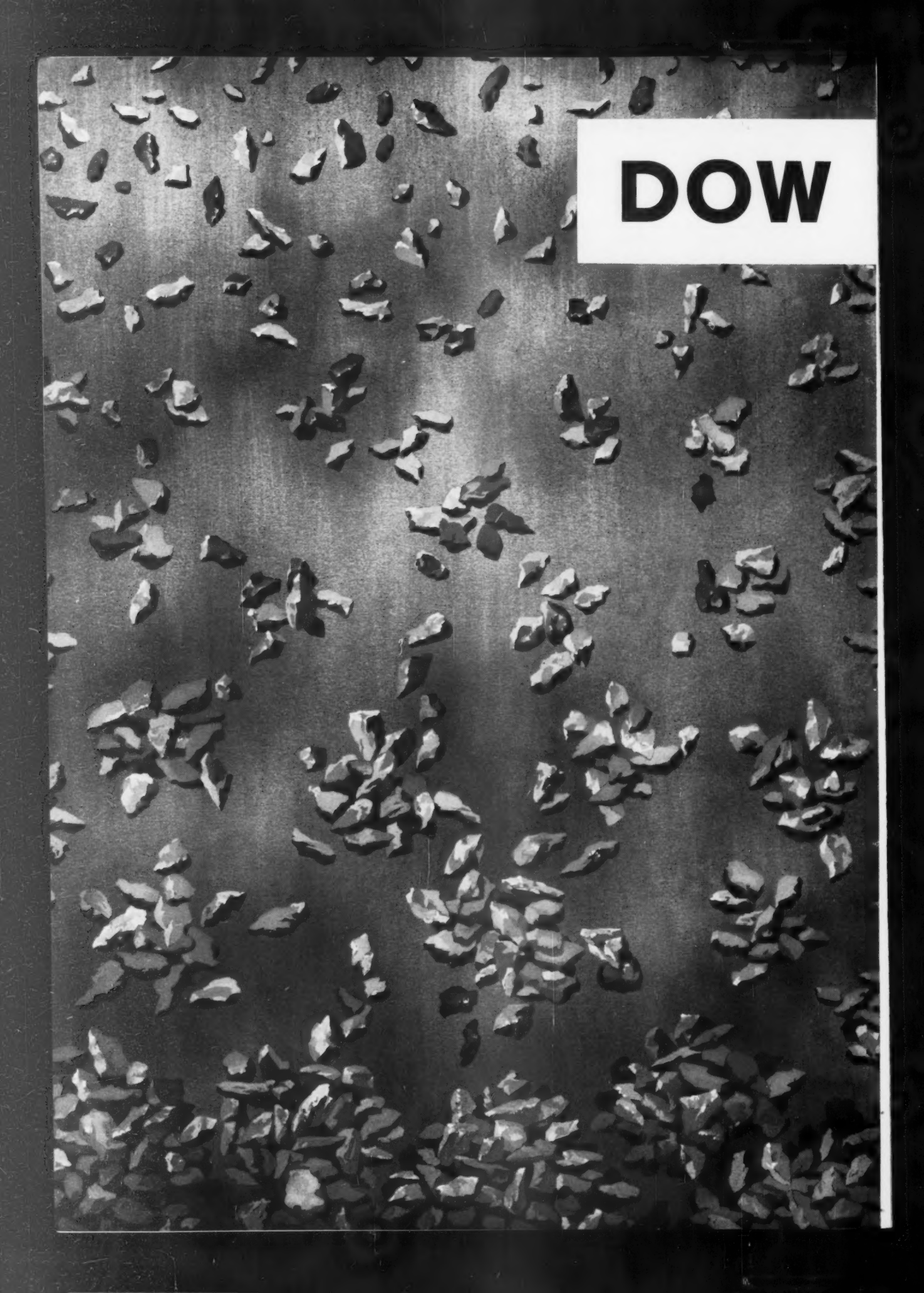
AVISCO® RAYON

AMERICAN VISCOSE CORPORATION, 350 Fifth Avenue, New York 1, N. Y.


DOW

mining chemicals

SEPARAN

SEPARAN IMPROVES SETTLING RATES UP TO 2800% IN ACID OR ALKALINE PULPS

Separan® flocculants can be relied upon to make drastic reductions in settling time on nearly every kind of suspended solid over the entire pH range. For example, it will flocculate solids effectively in 60% sulfuric acid, in leach solutions of pH 1, in neutral solutions, in hot 10% soda ash solutions, and in hot 4% caustic soda solutions.

Many milling operations have cut operating costs by using Separan to increase settling time, improve overhead clarity, and speed the filtration rate.

Separan flocculants are water-soluble polymers of acrylamide, which function most effectively at minimum dosages. And unlike some polyelectrolytes excessive amounts do *not* cause redispersion of the solids. Although no two ores are exactly alike, Separan has improved settling or filtration rates of copper, lead, zinc concentrates, and tailings. It has also proved effective in the production of potash, taconite, uranium, tungsten, manganese, barytes, coal, borax, soda ash, and ammonia-leached nickel. Complete technology is available from Dow.

IMPROVED SETTLING RATES WITH SEPARAN
(clear overflow)

	Lbs. Separan per ton of solids	Settling rate (inches/minute)		Percent improvement
		untreated	treated	
COPPER CONCENTRATES	.05	.11	.49	450%
ZINC CONCENTRATES	.03	1.82	8.0	450%
URANIUM SLIMES	.01	1.25	12.5	1000%
URANIUM ORE	.10	.068	1.93	2800%

For all your mineral processing problems involving chemicals, you may obtain expert assistance from the Dow Mining Technical Service Department. To obtain technical service or our new digest, *Chemicals for the Mining Industry*, write to THE DOW CHEMICAL COMPANY, Abbott Road Buildings, Midland, Mich., Attn: Chemicals Merchandising, Dept. 750BD3.

THE DOW CHEMICAL COMPANY DOW Midland, Michigan

12 P&H ELECTRICS IN THIS COPPER MINE PERU
12
P&H

7 P&H ELECTRICS IN THIS ASBESTOS MINE CANADA
12

5 P&H ELECTRICS IN THIS COPPER MINE U.S.A.
3
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4 P&H ELECTRICS IN THIS IRON MINE U.S.A.
P&H
1400
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9 P&H ELECTRICS IN THIS NITRATE MINE CHILE
P&H
1400
7

Throughout the Americas...

More mines are STANDARDIZING on P&H ELECTRIC SHOVELS

...more evidence that one P&H always sells another

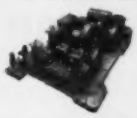
Look at the evidence: Count the P&H Electric Shovels now in use in each of the mines shown here. It's the same story you'll find in mine after mine: once a P&H electric shovel is on the job, performance records show production increases and lower unit costs that simply make it good business to standardize on P&H. Because more mines are following this trend, Harnischfeger now is the world's largest builder of full electric and diesel-electric shovels.

P&H Electric Shovels incorporate many dramatic new design fundamentals which make them different from all others.

Foremost is MAGNETORQUE® drive—the exclusive *patented* hoist drive that puts more material into the dipper, faster—with every pass! It is the most productive digging motion drive known for electric shovels, producing higher bail pull, greater dipper fill factor and automatic impact protection for the hoist machinery.

FIVE EXCLUSIVE P&H FEATURES

MAGNETORQUE DRIVE
Electro-magnetically transmits full digging power of A.C. motor direct to dipper—without motor generator set conversion to D.C. current.



FULL WELDED STEEL CONSTRUCTION
Unit-welded rolled steel design pays dividends in exceptionally long shovel life in hard digging.

ENCLOSED HOIST MACHINERY
No open gearing—all power trains for hoist, swing and propel drives are enclosed in oil-tight gear cases.

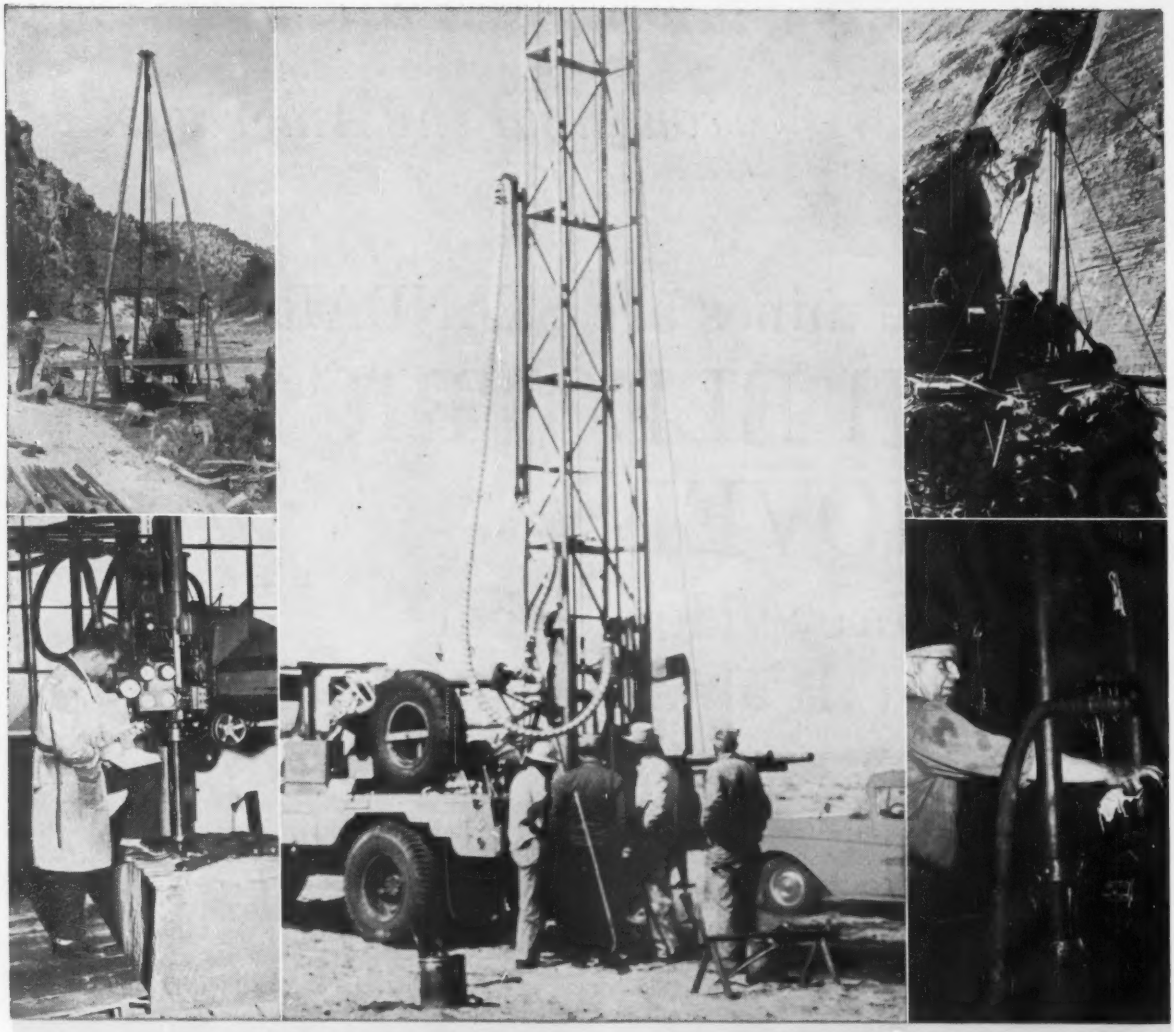
INDEPENDENT CRAWLER PROPEL MOTION
P&H gives you independent motors for each function—the basic principle of electric shovel design and purpose.

HIGH STRENGTH T-1 STEEL
Only Harnischfeger uses it as *standard* in fabricating a boom and dipper handle with highest impact absorption ability.

Another major reason why "One P&H Always Sells Another" is single-source responsibility for service. Harnischfeger is the only shovel manufacturer which makes its own electrical as well as mechanical components—all designed and matched by a single manufacturer *specifically for balanced electric shovel production cycles.* For more information write Harnischfeger Corporation, Milwaukee 46, Wisconsin.

HARNISCHFEGER
Milwaukee 46, Wisconsin

P&H
CONSTRUCTION & MINING DIVISION



Operate at "Less cost per foot" . . .

. . . with Christensen diamond bits and core barrels "engineered" for your particular drilling problem. Experienced field consultants are available regardless of your job location or scope of operations.

"Less cost per foot"

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MAIN OFFICE AND PLANT 1937 SOUTH 2nd WEST
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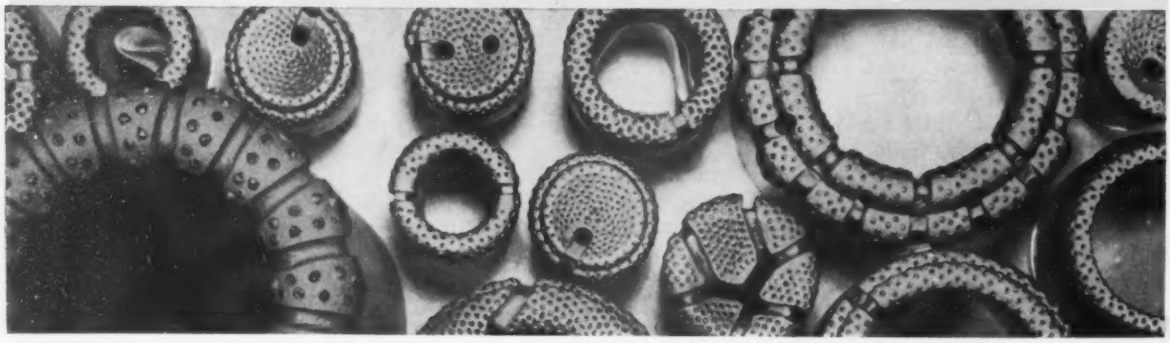
SERVICE FROM WORLD-WIDE SALES OFFICES AND MANUFACTURING PLANTS



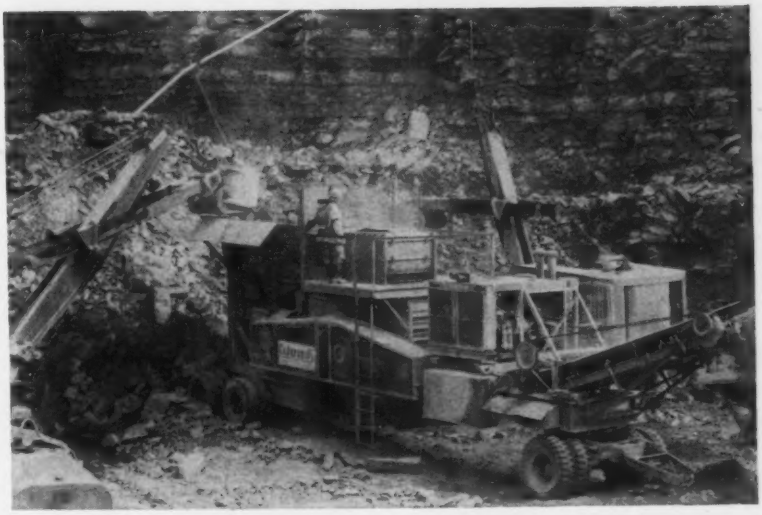
NEW PRODUCTS DIGEST

Iowa Announces Two Portable Primary Crushing Plants (5)

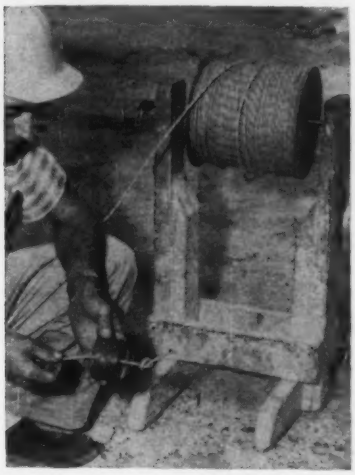
TWO NEW PORTABLE primary crushing plants, the 4336 and 3026 single impeller impact breakers with vibrating grizzly feeders, were recently introduced by Iowa Mfg. Co. The 4336 has a capacity of 200-400 tph and the 3026 is rated at 150-250 tph and both models can be easily disassembled to meet necessary road weight limits.

The new series are ideally suited for low silica material and produce a high volume of cubical aggregate with a low percentage of fines and a minimum of slabs, slivers and soft stone. Plugging or clogging with soft, sticky material is also held to a minimum.

The breakers have heavy hot-rolled steel side plates protected by thick abrasion-resistant manganese steel liners. Material is first struck by whirling impellers and then hurled against a breaker plate and breaker bar for secondary reduction. A large unobstructed discharge opening allows free flow of material to the delivery conveyor.



Model 4336 is available with an apron feeder to give a controlled material flow to the breaker. The rugged feeder has thick flights which resist loading impact and overlap to prevent leakage. A clutch gives complete feed rate control.

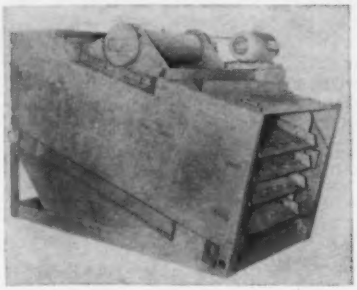


Improved AN Booster (10)

LAST FALL, Spencer Chemical Co. introduced the first boostering material specifically designed for use with ammonium nitrate-fuel oil mixtures. They called it "Spenite" and said that it was developed in conjunction with the Armour Research Foundation and that it had been undergoing tests for approximately one year. Spencer said that it had been able to reduce the number of boosters normally used per hole and was still obtaining excellent results.

According to Spencer, the tests showed that, for efficient boostering of ammonium nitrate-fuel oil mixtures, the heat which the booster generates is equally if not more important than velocity of detonation—the common standard of boostering efficiency. Spenite's explosive heat is 50-75% greater than with other commercial boosters.

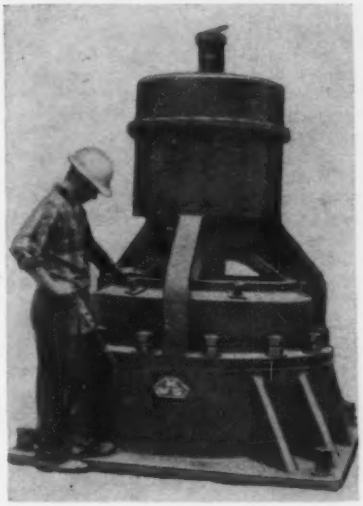
A Spenite booster weighs 10 oz and is packaged in a specially-designed 3- by 1-¾-in. plastic container. During hole loading, a 50-grain blasting cord is threaded through a single hole in the center of the Spenite container and knotted. The cord and booster are then lowered into the bore hole. Additional boosters can be added as needed. The hole is filled with ammonium nitrate-fuel oil mixture, stemmed and shot in the usual manner.



Fully-Enclosed Screens (11)

DEISTER MACHINE CO. has developed fully-enclosed vibrating screens to counteract annoying ore dust problems.

The enclosure panels are made from heavy-gage steel and can be removed in a few seconds—swing bolts hold them in place. Screen tension adjustments and screen changes can therefore be done rapidly and without the need for expensive downtime procedures. Deister says the hinged top panels are equally as easy to open.



All New Crusher (2)

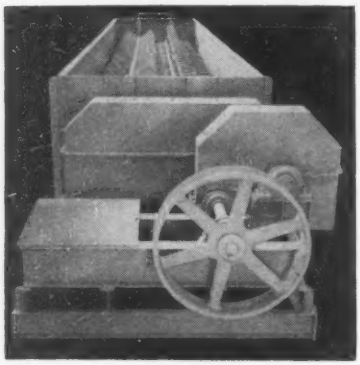
KENNEDY VAN SAUN Mfg. & Engineering Corp. has introduced a completely hydraulic reduction crusher which has a lower feed opening and requires less head room. Some of the new advantages that it offers for secondary and tertiary operations include: a main shaft that's top-supported by multiple hydraulic cylinders; a crusher setting automatically held in the set position by "posi-trol" (company's new and exclusive control device); simple, one-hand operated varying setting; a crusher that automatically rejects tramp iron without damage and that returns at once to correct setting; and a gearless drive.

Magnet-Filter Trap (12)

THE FIRST COMBINED ferrous trap and filter for installation on lines carrying various liquids or slurries has been developed by Eriez Mfg. Co.

Now, one compact unit removes both iron contamination and nonmagnetic particles. Heart of the new trap is a one-in. stainless steel permanent tube magnet enclosed in a two-in.-dia perforated bronze filter screen with either .020 or .033-in.-dia holes. Magnet and filter are enclosed in a 350-lb pressure bronze casting which has a standard two-in. pipe thread inlet and outlet.

The trap's design permits material to be passed over the magnet first and then the filter, or vice versa.



Larger Log Washers (14)

MCLANAHAN & STONE CORP. has expanded its line of Mudmaster log washers to provide increased capacities. Though the company developed the new units to process phosphates, they can also be used for crushed stone, manganese and iron ores.

The new units have 12-in. logs which make possible a greater paddle arc—gives greater cleaning action and larger output. In the 12-in. x 30-ft size, the Mudmaster has an estimated 30% greater output than the equivalent 10-in. model, formerly the company's standard length log.

Main components of the McLanahan washer are: heavy gage, steel plate washer with adjustable slope; square logs and paddles; patented hydraulic gudgeon cut tooth, spur gear drive train running in an oil bath.

Map Preparer (15)

MAP AND CHART preparation can be greatly speeded and simplified with the new, automatic 55 Map-O-Graph, a vertical opaque projector being introduced by Art-O-Graph Inc.

Map-O-Graph handles material of any width or length and either reduces or enlarges it up to five times in perfect scale. Trays hold the portions of the map not being projected.

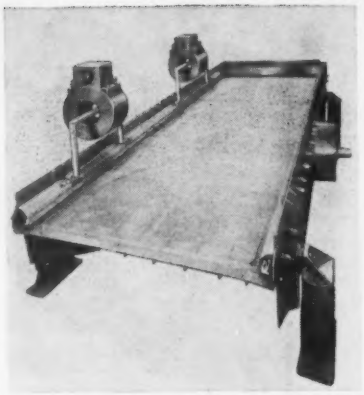
The correctly scaled image, projected directly onto the drawing board, is then accurately transferred to any other map, or to fresh paper, without intermediate steps. Art-O-Graph says that time-consuming work with proportional dividers or with a planograph is eliminated.

Soviet Ventilator

MCGRAW-HILL World News Bureau's Moscow office recently reported that Ukranian engineers reportedly have developed a mine ventilator which can supply 1.06-million cu ft of air per minute.

The report originally came from Tass and said the ventilator, which would be used at mines in the Krivoi Rog area and the Kursk magnetic anomoly, could eject air at a velocity of 65 ft per second.

Tass said that "even in the dustiest headings, at a depth of more than one kilometer, the ventilator will lower the temperature and create normal working conditions."

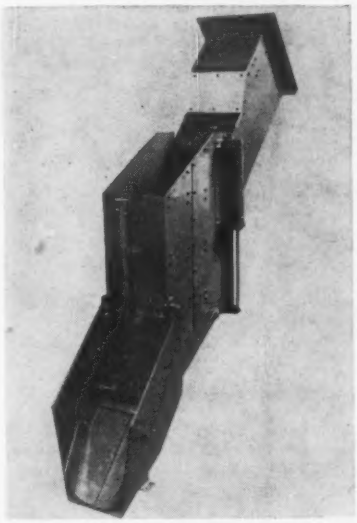


Improved Screen Heater (34)

EFFICIENT ELECTRIC screen heaters which can conduct up to 4,000 amp through the air, eliminating any electro-mechanical connection, have been developed by F. R. Hannon & Sons, Div. of Hannon Electric Co.

According to the company, the unit does away with the costly replacement of flexible cables and leaf type laminated conductors which tend to restrict screen vibration.

HANCO heaters are waterproof, dust-tight, 220/440/550 v and three phase on larger models. A hollow ventilated conductor bar transmits power from the heater unit to the screen and is so designed that it can be rigidly fastened to the screen frame. The bar passes through the heater opening and picks up the power transmitted through the air.



Automatic Loading Pockets (6)

VULCAN IRON WORKS is now furnishing loading pockets to be used with their automatic skips. The automatic pockets, Vulcan claims, reduce manpower and speed the hoisting cycle.

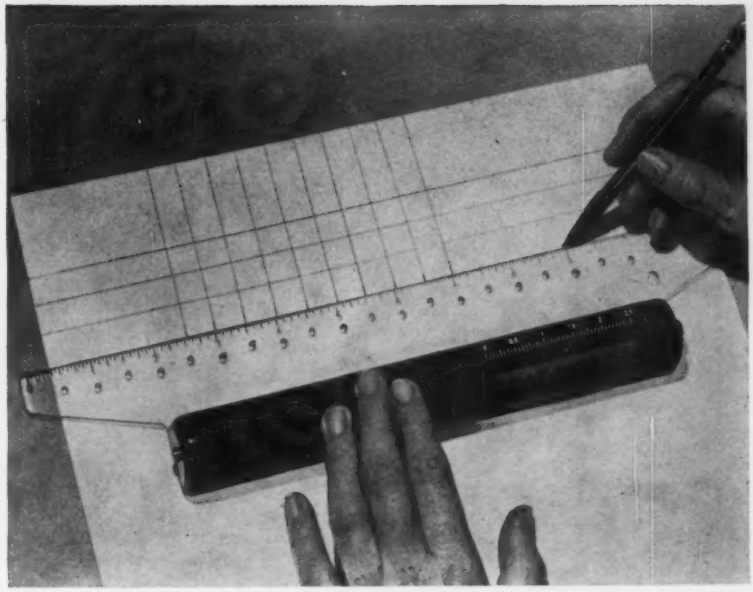
The pocket's gages are pneumatically operated—upper gate is a guillotine type and the lower is hinged to open under pressure when the latch arm is raised.

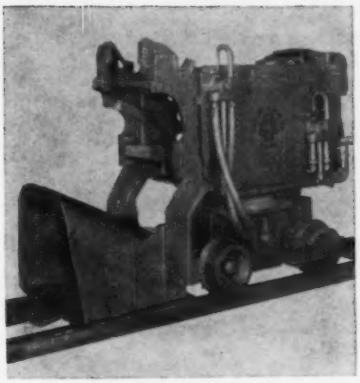
Measuring pocket can be equipped to load by weight rather than volume.

T-Square, Parallel Ruler Triangle (42)

COMBINATION PLASTIC triangle, T-square, and parallel ruler which has a built-in roller, is ideal for quickly and accurately drawing vertical, horizontal and angular parallel lines. Made in West Germany and sold in the U.S. by Rol-Ruler Co., the instrument can also produce circles and arcs with diameters up to 22 in.

Rol-Ruler said that a spiral index window automatically indicate distances between horizontal and angular lines as close as 1/16 in.





High Capacity Loader (8)

GARDNER-DENVER CO. has developed a mine car loader which they say is safe, fast, easy to operate, and which is capable of filling any mine car more completely than any other loader in its class. The company calls it the GD18 and claims that it gives up to 97% faster loading rate per car in iron ore at any pressure from 50 psi to 100 psi.

Improved Diaphragm Pump (4)

UNIQUE, LOW-COST two-in. pump, the DA-4, has been added to Layton Co.'s line of pneumatic diaphragm units. It is self-priming and ejects a high percentage of solids and highly abrasive liquids. It may be completely submerged in liquid or used with a suction hose.

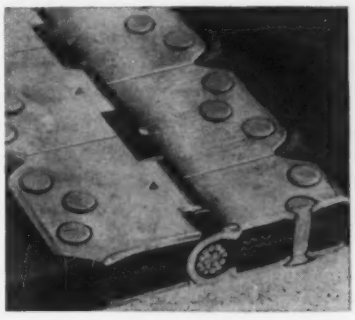
The Model DA-4 is 21-in. high, has a maximum length and width of 16¼ in. and weighs 79 lb. It consumes only 20 cfm of air at 100 psi, delivers 6,300 gph at a 10-ft discharge head and pumps against heads of 100 ft or more.

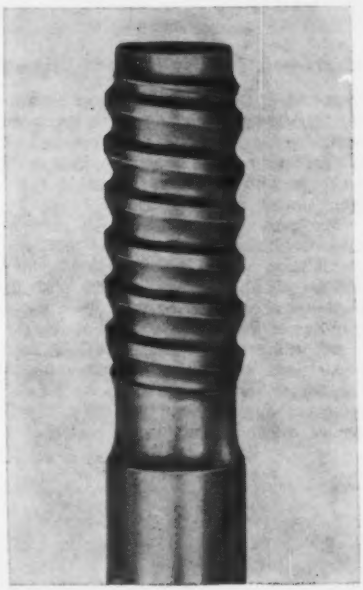
According to Layton, the neoprene diaphragms that keep compressed air away from the water column give smooth, positive, more effective pumping action and longer pump life. The power cycle is done by a reciprocating spool valve, actuated by a pilot valve directing air against one diaphragm and causing it to distend and displace the liquid being pumped. At the same time, the opposite diaphragm is being drawn in, and, at the extreme inward stroke, the pilot valve pneumatically shuttles the spool valve to reverse the air flow and direction of diaphragm movement.

Improved Belt Splicer (3)

CONVEYOR INSTALLATIONS using belts made entirely of interwoven carcass may now be joined with a reversible belt splice designed for quick installation, according to the General Splice Corp.

The heavy duty, hinge-type "MINET" splice eliminates the need for templates, drilling or hole punching—splice is installed in one piece. As the conveyor operates, the hinge plate separates into sections at pre-scored notches to conform with conveyor trough curvature. The one piece design assures closest possible fit and gives a tight, leak-proof yet flexible joint.



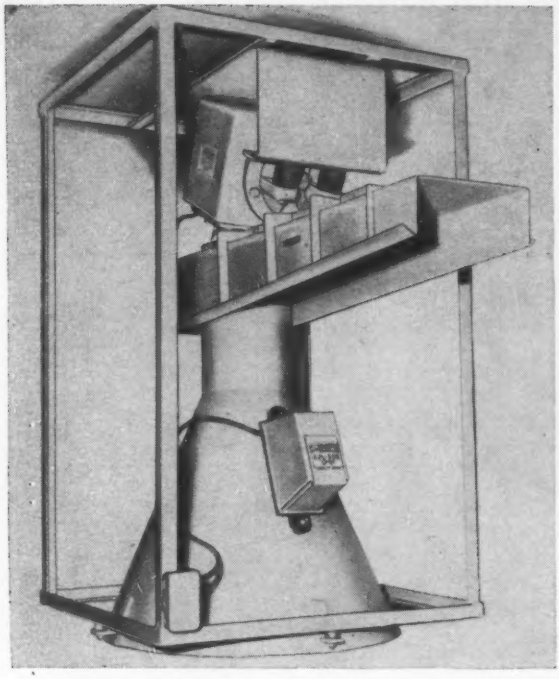


Improved Threads (9)

HL-16 AND HL-17 threads are now available on the complete line of Brunner & Lay long hole drilling accessories—carbide Rok-Bits, extension steel, couplings and striking bars. The wide HL threads assure maximum wear, tight connections, greater rod rigidity, plus easy hand uncoupling.

Seven Strand Wire Rope (38)

MACWHYTE WIRE ROPE CO., Kenosha, Wis., has introduced a seven-strand wire rope which it claims combines the best features of conventional six-strand and eight-strand products.

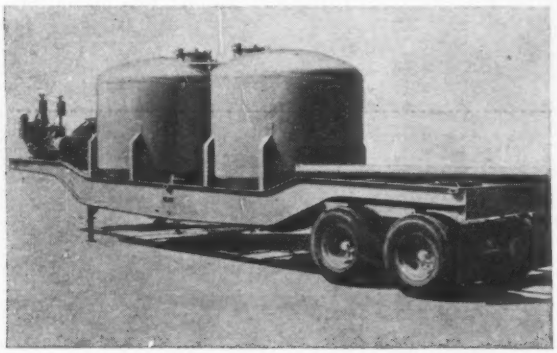


Improved Feeder-Hopper-Vibrator (18)

ERIEZ MFG. CO. improved feeder-hopper-vibrator combination, the HI-VI Volumatic Feeder, is a compact, enclosed, one-piece device with extremely precise controls and dual vibratory action. Instant starting and stopping, added to the first two advantages, make possible measured discharge rates for moving material from storage bin to feeder.

The core of the Eriez HI-VI drive system is a permanent magnet which in effect replaces rectifiers by giving an inherent rectification system which adds efficiency. The magnetic drive and an associated spring system push up and forward on the tray assembly and then pull down and back—material in the tray moves forward in a series of hops.

According to Eriez, the operating benefits of its Volumatic Feeder are: elimination of rear-end dead spots and front-end flip; adjustable discharge spout on the steel hopper can be easily removed; and the unit can be easily cleaned and protected against moisture and foreign materials.



Self-Unloading Trailer (37)

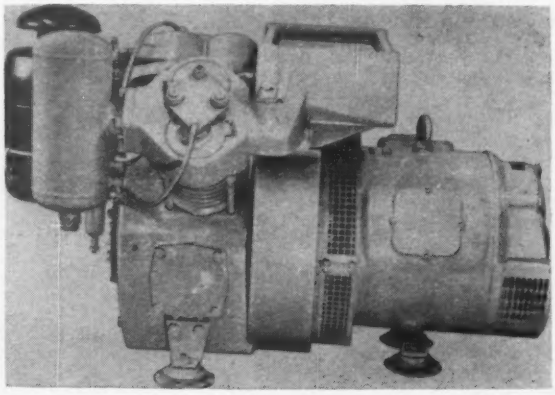
HEIL CO., MILWAUKEE, WISC., manufactures a twin-tank, dry-bulk materials trailer, the "Jet-25", which self-unloads at a rate of up to 4000 lb per minute through 4-in. apertures. The material is forced out under high pressure air and flows in a high-density condition. Either powdered or granular products may be hauled and discharged by the trailer.

Versatile, One-Man Rig (16)

ROTARY DRILLING RIG, the Model H.D. 250-S HI-VACuum which is a "new, one-man, self-operated, self-contained, hydraulically, highly versatile" unit, has been designed by Houston Tool Co. It operates on a 30-hp, four-cylinder, air-cooled engine with four speeds forward and one reverse. The rig has a tongue and hitch and, for easy towing, the hydraulic system can be neutralized by a single valve.

Model H.D. 250-S is completely self-contained—carries all of its own equipment, plus 250 ft of drill pipe. Twin, clear plastic tubes allow the operator to continuously examine the stratum and take samples without interrupting the drilling.

Houston's machine vacuum drills (needs no water in dry formations, takes a 100% continuous sample, and cannot lose circulation even in broken and fissured formations), and also drills with forced air; with forced water; with reverse water; vacuum with water; drive core sampling; augering; bucket drilling; and can also drive casing while drilling.



Air-Cooled Compressor (17)

ATLAS-COPCO recently introduced a new 30-hp compressor capable of delivering 141 cu ft of air per minute. The compressor, called the TT6, rests on rubber pads and is ideal for both permanent installations and temporary job sites—offers all of the advantages of a heavy-duty machine while retaining the flexibility of a portable compressor.

TT6 is a two-stage, single-acting unit and is totally air cooled. It's available in sizes from 1,050 lb to 1,350 lb and has an output of 115 cfm at 100 psi when running at 1,170 rpm and 141 cfm at 100 psi at a speed of 1,450 rpm.

For Your Files

This selected manufacturer's literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.

HANDBOOK OF STEEL SELECTION, "Three Keys to Satisfaction", has just been published by Climax Molybdenum, division of American Metal Climax, Inc.

In 77 professionally-prepared pages, the company outlines the necessary treatment to give optimum economy and material performance, and, with tables and charts, shows how it's possible for fabricators to: (1) Increase the endurance limit of properly-selected steels fivefold when good heat-treatment practices are applied, and; (2) Increase the endurance limit of properly-selected steels tenfold when both sound design principles and good heat-treatment practices are combined. **(81)**

GC-2A GAS CHROMATOGRAPH is fully explained in a recently published brochure (Bulletin 787) from the Scientific and Process Instruments Div., Beckman Instruments, Inc.

The company said that the instrument uses a thermal conductivity filament detection system and that it's extremely valuable for trace analyses, even with very small samples. The GC-2A can be equipped with small diameter, high efficiency columns for fast analyses; with larger diameter columns for trace analyses; and with columns for preparative gas chromatography. **(82)**

ALL INFORMATION necessary to select the proper mechanical power transmission timing-belt drives with minimum arithmetic is packed into a new 80-page catalog (19103) from T. B. Wood's Sons Co. **(83)**

NEW SIZES have been added to Goulds Pumps, Inc.'s Model 3405 line of single stage, double suction centrifugal pumps and are fully described in the company's Bulletin No. 721.6. **(84)**

FALK CORP.'S Bulletin 4100 presents its complete line of torsionally resilient Steelflex couplings. New pages, additional coupling types, dimensions for larger sizes, and easier methods of selection are included. How Falk's unique grid-groove coupling design protects connected machines against shock, vibration, and misalignment is explained and illustrated. **(85)**

NEW LINE of adjustable speed drives for application in the ¾ to 2,500-hp range is described in Louis Allis Co.'s six-page Bulletin 2900.

The company presentation describes four types of complete packaged adjustable speed drives and gives details on available ratings, speed ranges, type enclosures, associated controls and many standard and special modifications. **(86)**

RECENTLY-INTRODUCED patented "7-FLEX (R)" wire rope from Macwhyte Wire Rope Co. is outlined in the company's new Bulletin 5702-R.

The four-page brochure shows wire arrangements on dozers, draglines, shovels, and scrapers and also cross-sectional views of cable constructions and a section comparing lang lay and regular lay rope. **(87)**

AEROQUIP CORP. has published an extremely informative 16-page guide which tells how to measure and relate pipe, tubing and hose sizes.

The illustrated- and chart-filled booklet is important because it's basic. After telling how one should go about measuring pipe, it touches on the following topics: rigid tube dash numbering system; how to measure tubing; adapters; single wire braid hose dash numbering system; dash sizes for pipe threads; and low pressure hose and fitting dash numbering system. **(88)**

"MAGNETIC IDEAS FOR AUTOMATION" is the title of a 50-page bulletin (B-215) from Eriez Mfg. Co. Every page gives a specific diagrammed problem and shows how it can be solved by any one of a number of magnetic attachments. After Eriez presents the 44 fully-discussed case histories, it devotes 10 pages to detailed engineering drawings of its many magnetic units designed for automation. **(89)**

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McGRAW-HILL PUBLISHING COMPANY, INC.
ENGINEERING & MINING JOURNAL
330 WEST 42nd STREET
NEW YORK 36, N. Y.

E&MJ NOT GOOD AFTER SEPTEMBER 1, 1961 **MARCH 1961**

Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled.

1	11	21	31	41	51
2	12	22	32	42	52
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62	66	70	74	78	82	86	90	94	98
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No. 1

E&MJ NEW PRODUCTS DIGEST *(Continued)*

HOLDBACK CLUTCHES specially designed to prevent runback or traverse travel of inclined conveyors, bucket elevators, capstans, and related materials handling or operating equipment is discussed in a new 10-page catalog from Formsprag Co. **(90)**

ATHEY PRODUCTS CORP. has just published a 12-page booklet which, they say, provides practical answers to unique hauling problems, particularly for jobs that cannot be handled by conventional wheeled vehicles. Called "Athey Forged-Traks", the booklet tells how the units have become the key component in a broad range of specialized hauling and transport equipment. A number of on-the-job applications are illustrated along with full explanations of the many problems they have solved. **(91)**

DUCTILE IRON regulators and control valves are featured in a new four-page booklet (Bulletin J-DI) from OPW-Jordan. The brochure describes the composition, properties and specifications of ductile iron valves and has a comparison table on steel, cast iron, and red brass versus ductile iron, plus the results of a severe quence test on ductile iron. **(92)**

HOW DEEP DIGGING Slackline Cableways are used to recover sand and gravel deposits; clean river channels and settling ponds; excavate and haul bulk materials is explained in Sauerman Bros. newly released 17-page Catalog C. **(93)**

HARDINGE CO., INC., has just published a completely revised, 24-page catalog on Ruggles-Coles dryers, heaters and coolers, No. 16-E. The catalog includes new material on fundamentals of drying, selection of proper drying equipment, and drying economics. **(94)**

STUD-MOUNTED semiconductor bases and mating caps are reviewed in a four-page bulletin (Form 2714) from Standard Pressed Steel Co. **(95)**

FEATURES of the recently-introduced Allis-Chalmers Models 10000 and 11000 diesel engines are described and illustrated in a new eight-page catalog (BU-718. **(96)**

NEW CATALOG from Mine & Smelter Supply Co. describes a system for automatic opening and closing of pinch valves. The system, called Massco-Grisby Hydral 60, consists of one or more pinch valves with a single automatically-operated hydraulic pump. According to Mine & Smelter, the pump may be operated by electric motor or by air from normal plant supply system. **(97)**

COMPREHENSIVE, 16-page bulletin showing features and capabilities of the recently-introduced P&H Model 255B-TC truck crane is now available from Harnischfeger Corp. **(98)**

NEWLY INTRODUCED LINE-FLEX cable suspension system for a variety of mining applications is described and illustrated in a four-page catalog from Perfect-Line Mfg. Corp.

According to the company, LINE-FLEX sheathing is a modern, simpler method of permanently, or temporarily, suspending heavy electrical cable without the need for special equipment, tools or training. **(99)**

NEW FOUR-PAGE sizing chart bulletin JSC-1 shows how to size OPW-Jordan's sliding gate regulators and control valves. Simplified charts cover steam, liquid, and gas service and a cross-reference compiling method makes sizing easy—no need for rulers, formulas, or slide rules. **(100)**

"MATERIALS FOR ADVANCED TECHNOLOGY" is the title of a new eight-page booklet from the Carborundum Co.

The materials that are described in data-packed brochure offer important opportunities for improved design and performance in applications requiring resistance to abrasion, chemicals, corrosion, nuclear radiation and high temperatures. **(79)**

EIMCO CORP. has published an illustrated 24-page bulletin (SM-1006-R) to describe the many types and applications of its reactor-clarifier treatment units for water and waste clarification.

The company said that an interesting feature of the new bulletin is a series of wash drawings in full color showing flow patterns through the reaction and clarification compartments, —shows how coagulation, flocculation, recirculation and clarification are achieved in reactor-clarifier units. Complete specifications are included. **(80)**

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McGRAW-HILL PUBLISHING COMPANY, INC.

ENGINEERING & MINING JOURNAL

330 WEST 42nd STREET

NEW YORK 36, N. Y.

Rough going . . . yet maintenance problems eliminated with Chevron Vistac Oil

High humidity, dripping water, and mine dust could spell trouble for jack drills at this Cherokee Mine, near Randolph, Utah. It's 400 feet underground and a half mile back into the mountain. Yet despite high grit and moisture conditions, Chevron Vistac Oil reduces wear and lengthens equipment life for San Francisco Chemical Company.

"We've eliminated maintenance problems on our air operated equipment," reports Underground Mining Superintendent, Charles Stephens. "Chevron Vistac Oil keeps our drills and other machines functioning far beyond the usual service periods without repairs or breakdowns. We've used Chevron Vistac since 1952 on drills, tugger hoists, muckers . . . over 40 different machines."

250,000 tons of ore a year are mined from these rich phosphate deposits in the Cherokee Tunnel. Crews and equipment work 8 hours a day, five days a week, all year long.

CHEVRON VISTAC OIL cuts drill wear and power loss because it forms a tough oil film that clings tightly to moving parts, despite heavy shock loads, moisture and wide ranges of operating temperature. It's easy to work with because special additives reduce fogging—help prevent contamination from close air in mine tunnels.

Why not try Chevron Vistac Oil? Chances are it can cut your costs, lengthen equipment life. Just call your local representative or write any company listed below:

CHEVRON Industrial Lubricants

STANDARD OIL COMPANY OF CALIFORNIA, San Francisco 20 • **STANDARD OIL COMPANY OF TEXAS,** El Paso

CALIFORNIA OIL COMPANY, Perth Amboy, New Jersey - Denver, Colorado

TRADEMARK "CHEVRON," "VISTAC" AND CHEVRON DESIGN REG. U.S. PAT. OFF.

At Kennecott's new refinery... Twin Heroult Electric Furnaces designed

Copper cathodes are charged into the 13,500 KVA Heroult 90-ton electric arc furnace, one of two at Kennecott Refining's new plant south of Baltimore. American Bridge also fabricated and erected the plant's structural framework.

to keep 16,500-ton per month copper melt on schedule

Kennecott Refining Corporation's electrolytic copper refinery near Baltimore is the country's newest—a showplace of efficiency. One reason: a pair of 90-ton Heroult electric arc furnaces, each rated at 40 tons per hour.

Of nose-tilt design to facilitate launder pouring, they discharge a steady stream of molten copper (2150°) which is used in the horizontal casting of wire bars and the continuous casting of billets. One Heroult is on normal capacity operation while the other is a spare for use during relining, when the pre-heat furnace is down, or when additional production is required.

Copper cathodes are preheated to about 1400°F and door charged into the Heroult arc furnace on a peel arm crane. The three-phase power input utilizing ultra-high speed mechanical positioning for three 20″ electrodes with high-speed sensitive regulators maintains a constant arc above the copper bath for uniform temperature casting.

The two 90-ton Heroult arc furnaces can be tilted 40° forward and 15° backward. They feature mechanically positioned masts and special water-cooled skew-back roof rings that introduce water flow at the critical roof juncture to prevent warpage and burn out.

Whatever your arc-melt problem there is a Heroult electric arc furnace design for you. We've made them from 3 tons to over 200 tons capacity, for both swing roof top charge or door charge operation. They can accommodate induction stirring equipment, and can be designed for duplexing arrangements. And every Heroult is designed for maintenance by your own crew.

American Bridge has a complete electric furnace service that includes new installation, furnace modernization and part replacement. We'll be happy to quote on your building needs, too. Call our nearest office.

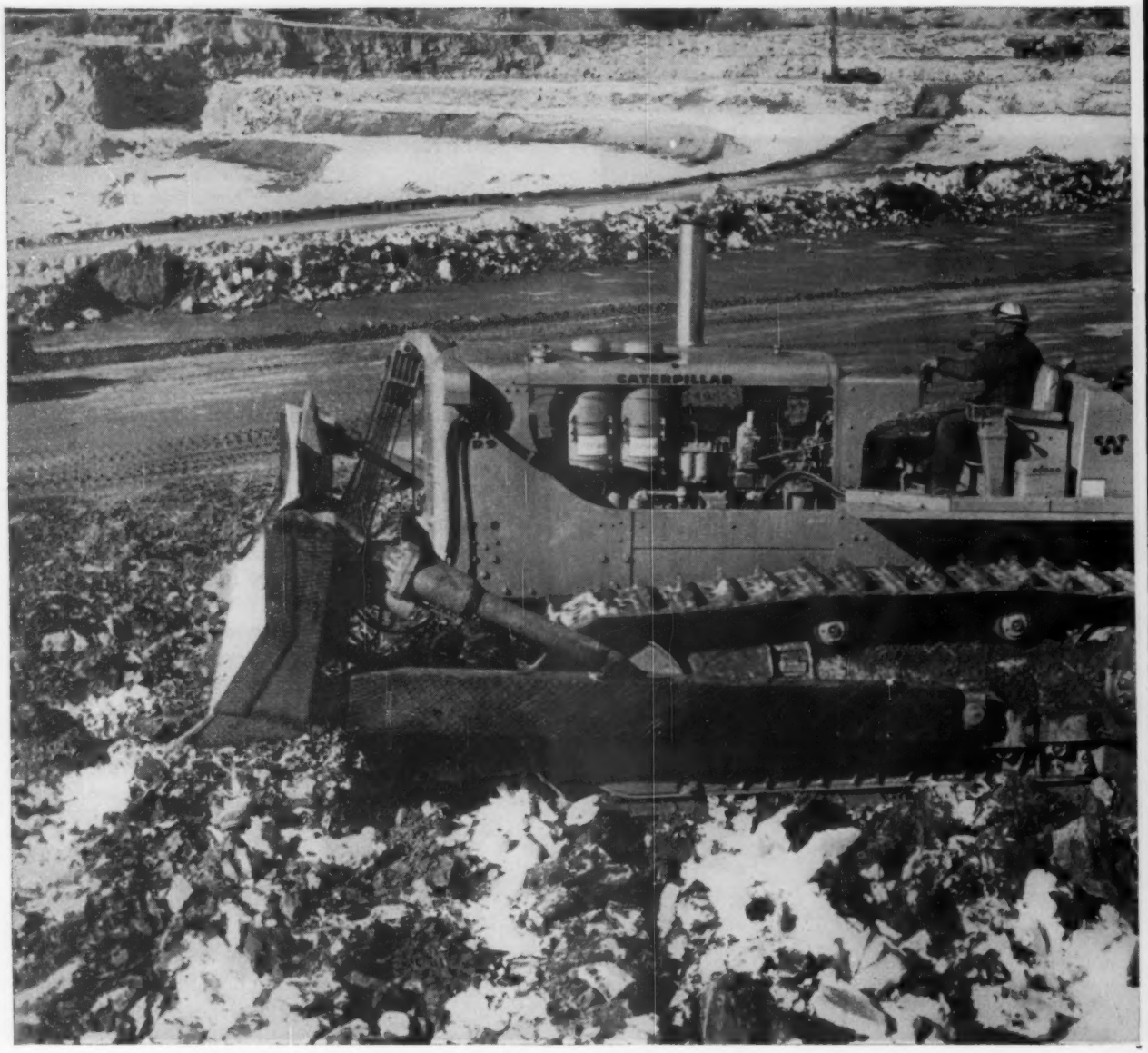
USS and Heroult are registered trademarks

American Bridge
Division of
United States Steel

USS

General Offices: 525 William Penn Place, Pittsburgh, Pa. Contracting Offices in New York, Philadelphia, Chicago, San Francisco, and other principal cities.
United States Steel Export Company, New York

This mark tells you a product is made of modern, dependable Steel.



If you're blasting rippable material, your money's going up in smoke

Mining operations are getting quieter. The reason is that more and more owners are replacing expensive blasting of ore and overburden with relatively inexpensive ripping.

The silence will never be complete, of course. Some material is simply not rippable, even with the brute strength of the big Caterpillar D9E Tractor.

But where material *is* rippable, it is considerably cheaper to rip than to drill and blast. Simple arithmetic supplies the most important reason. Add up these costs: power source, compressor, drills, drill bits, labor and supervision for drill and powder crews, dynamite truck, powder and primer, insurance, access roads and benching for drilling equipment.

Then compare the total with the owning and operating cost of a ripping tractor.

And there are other cost-saving advantages in ripping:

1. Ripped pieces of material tend to be smaller than blasted pieces, which means easier, faster handling and increased production. The spacing, depth and direction of ripping passes can be varied to obtain the desired size pieces, eliminating

HOW RIPPING WITH A D9E SOLVED A DIFFICULT AND UNUSUAL MINING PROBLEM

Mining of the main deposit had been completed at a uranium mine—but an excess of 50,000 tons of commercial grade ore still remained in scattered lenticular deposits around the bottom of the pit. They varied in depth from two to six feet, some occupying areas as great as 1000 square feet.

Problem: how to mine them economically.

Blasting would have been uneconomical since the commercial grade ore would have been diluted with surrounding low-grade ore and waste material. Shovel excavation without prior shattering would have been extremely slow, if possible at all.

Engineers suggested trying a tractor-mounted ripper. Tests indicated that this was the answer, and mine supervisors ordered a Caterpillar D9E Tractor with power shift transmission. Attachments included a No. 9 Ripper with two teeth and a No. 9S Bulldozer with tilt cylinder to give added prying action in digging out ore chunks in the more heavily consolidated portions of the formation.

The material is first ripped to a depth of 28 inches on 4-foot centers. Then it is cross-ripped (shown in photo at left) to break the heavily consolidated ore into easily handled pieces for shovel loading. The D9E bulldozes the pieces into a pile for loading into hauling units. Ripping and bulldozing production averages from 300 to 500 cu. yd. per hour. In addition the D9E handles road maintenance.

No other machine is as well suited to this kind of rugged mining work as the D9E. With 335 HP (flywheel) and a massive, long-lived undercarriage, it has the power and stamina to do the job. But, more important, it can do the job at *reasonable cost*. For the D9E's rugged construction and dependable Cat Engine mean that it stays on the job hour after hour, day after day, doing the work you bought it for.

Talk over your ore and overburden removal problems with your Caterpillar Dealer. If it is his best judgment that Cat-built equipment is the answer—he's ready to prove it to you with a demonstration.

Caterpillar Tractor Co., General Offices, Peoria, Illinois, U. S. A.

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

expensive and time-consuming secondary blasting.

2. Ripping is safer than blasting. And in many cases this can mean lower liability insurance rates.

3. A ripping tractor offers the extra dividend of availability for various bulldozing jobs when it has completed its ripping assignments.

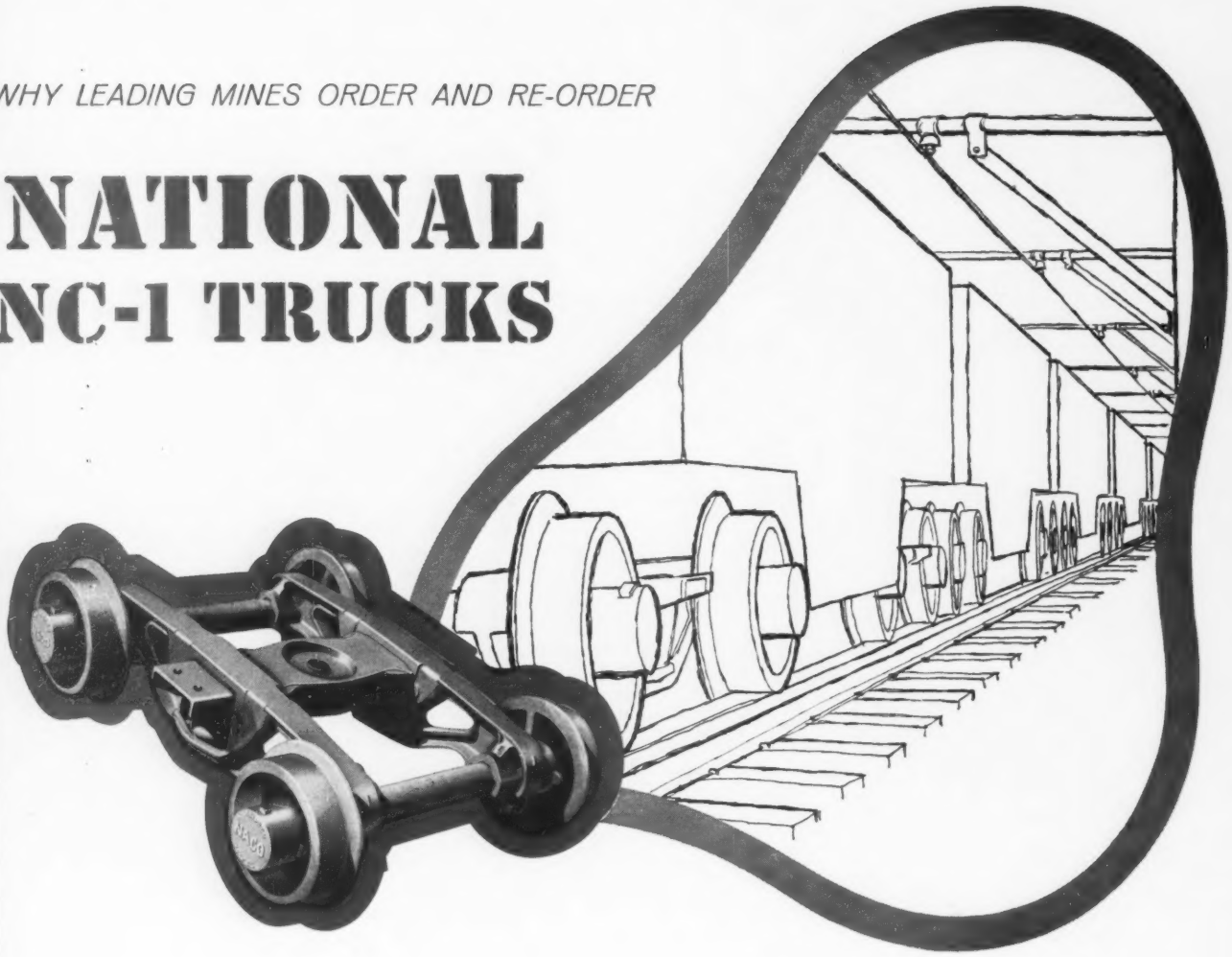
All told, the savings can be quite considerable. In fact, it is a rule of thumb that a ripping tractor used on a production basis can loosen ore and overburden for one-third to one-half the cost of drilling and blasting. In many cases, savings even top that. For example, on the Mesabi Range rock was ripped with D9s for *10% of the cost of drilling and blasting*.

The chart below gives some examples of typical savings. All are actual cases where Caterpillar track-type Tractors with rippers replaced drilling and blasting.

LOCATION	MATERIAL	Ripping Costs (Cents/Cu Yd.)	Drilling and Blasting Costs (Cents/Cu. Yd.)
Tulsa, Oklahoma	Limestone	7.3	17.3
Dallas, Texas	Limestone	5.2	15.1
San Francisco, Calif.	Sandstone	15.0	30.0
Merriam, Kansas	Sandstone	2.1	11.7
Nelsonville, Ohio	Sandstone	5.7	13.8
Philadelphia, Pa.	Limestone	11.5	19.3
Carbo, Virginia	Sandstone	8.6	15.7
Hibbing, Minn.	Frost	25.0	60.0
Hibbing, Minn.	Paint Rock	6.1	54.5

WHY LEADING MINES ORDER AND RE-ORDER

NATIONAL
NC-1 TRUCKS



The reasons for the decided swing to National NC-1 Trucks are fundamentally two: they provide safety to personnel and equipment... they make money for mine operators. There are lots of technical reasons, too. Let our representatives tell you all about them.

A-1792A

Mine Sales • Transportation Products Division

WILLISON AUTOMATIC COUPLERS
•
RUBBER CUSHIONING DEVICES
•
NACO STEEL WHEELS
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NACO STEEL LINKS
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MALLEABLE AND STEEL
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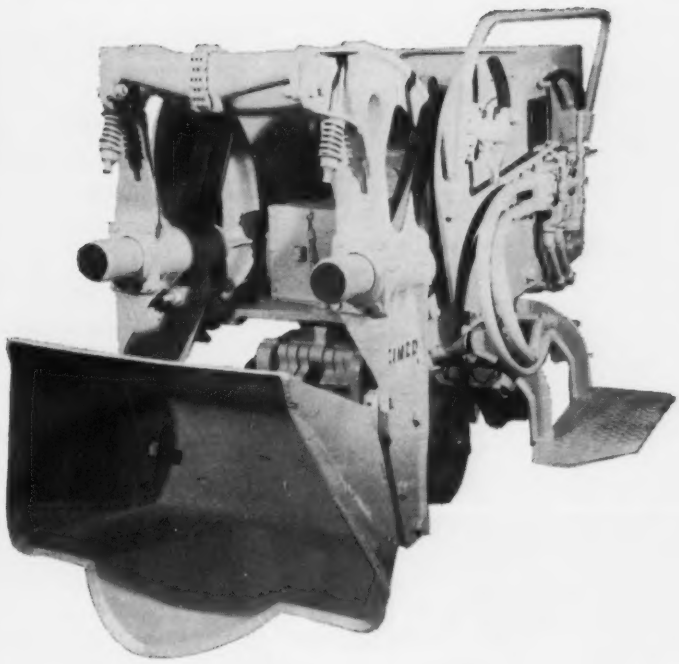
GET NEW EIMCO® 24 MUCKING CAPACITY...



OUTPRODUCES ANY OTHER LOADER ITS SIZE!

The new Eimco 24 RockerShovel® loader can muck out 60 cubic feet in just one minute. That's more than any other loader its size, and appreciably more than its predecessor the Eimco 21 RockerShovel, the standard of performance around the world. New design features have increased the mucking capacity...and lowered maintenance costs.

MUCK OUT MORE WITHOUT INCREASING AIR PRESSURE. The 24's rocker arms are re-designed to give greater lifting capacity. The cycle time is the same but the bucket is larger.

DIG IN FOR BIGGER BUCKET LOADS. The 24 can dig with greater force because patented, involute rail thrust ends give sturdy support to the rocker arms during crowding. You get solid positive thrust support, unlike other machines where nothing more than cables hold the arms in place.

LOAD LARGER AND LONGER CARS. New rocker arms give longer throw . . . increased range of discharge heights. What's more, patented, enclosed spring bumpers give maximum machine stability at discharge—and spring life too.

CUT SERVICE TIME AND COSTS. Now you can replace the rocker arm rails, easily and inexpensively. Heavy duty anti-friction bearings are used throughout. The 24 is built with the best, high strength steels and put together to last . . . with world-famous Eimco craftsmanship.

The Eimco 24 is bound to set new production records in the mining industry, and it can in your operation too! See for yourself. Contact your Eimco dealer, representative or write to The Eimco Corporation, P. O. Box 300, Salt Lake City 10, Utah for Bulletin L-1140A.

"ADVANCED ENGINEERING AND QUALITY CRAFTSMANSHIP SINCE 1884"

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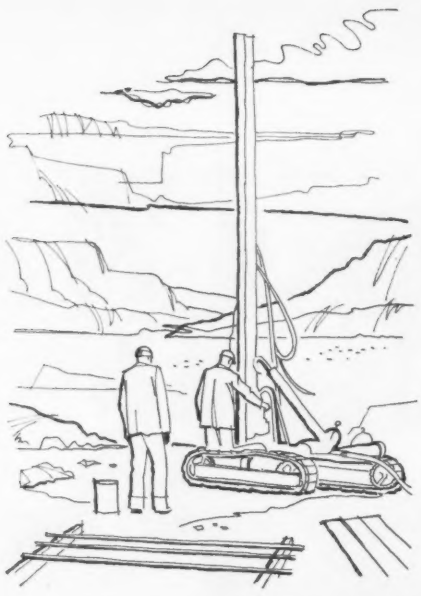
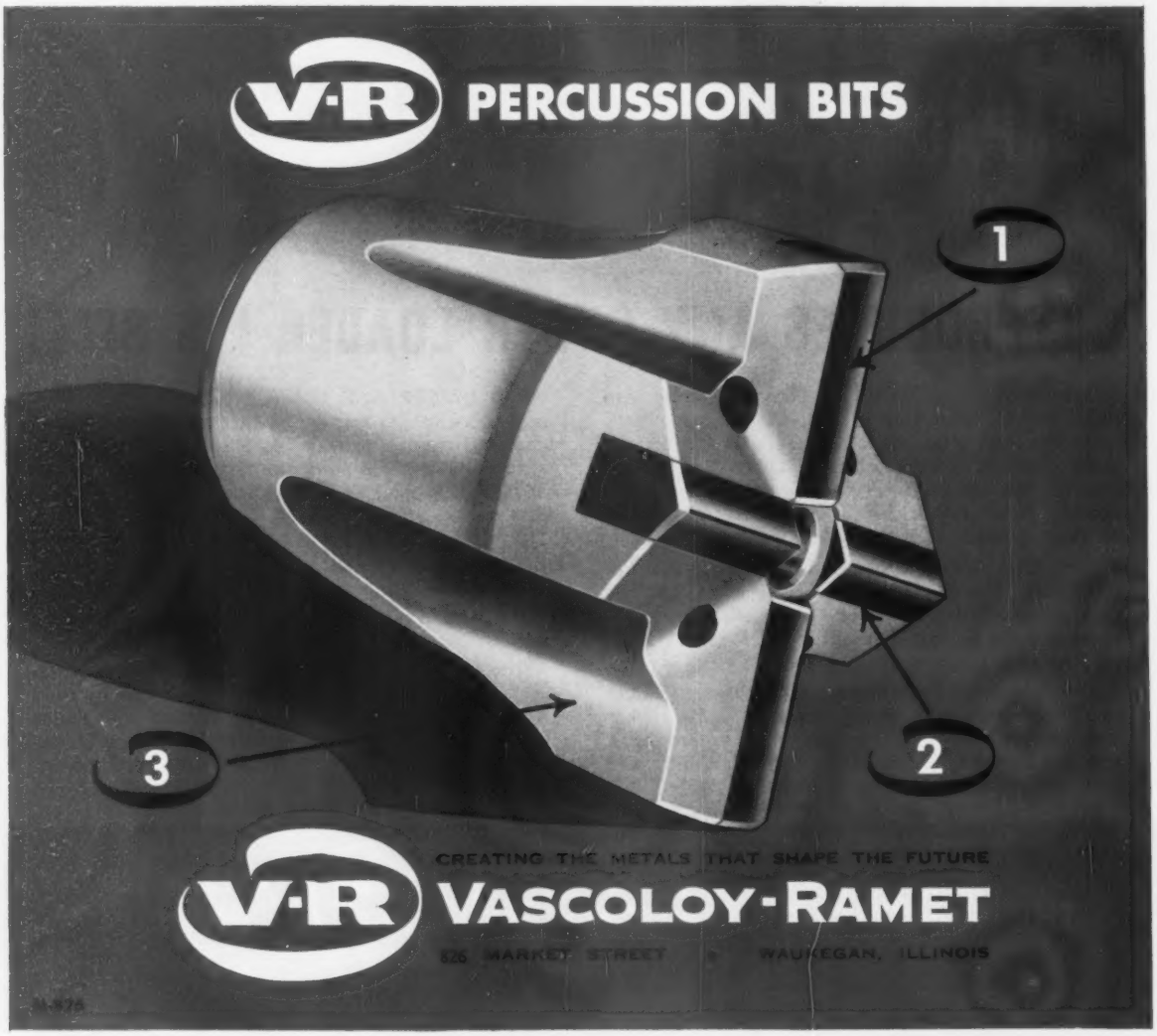


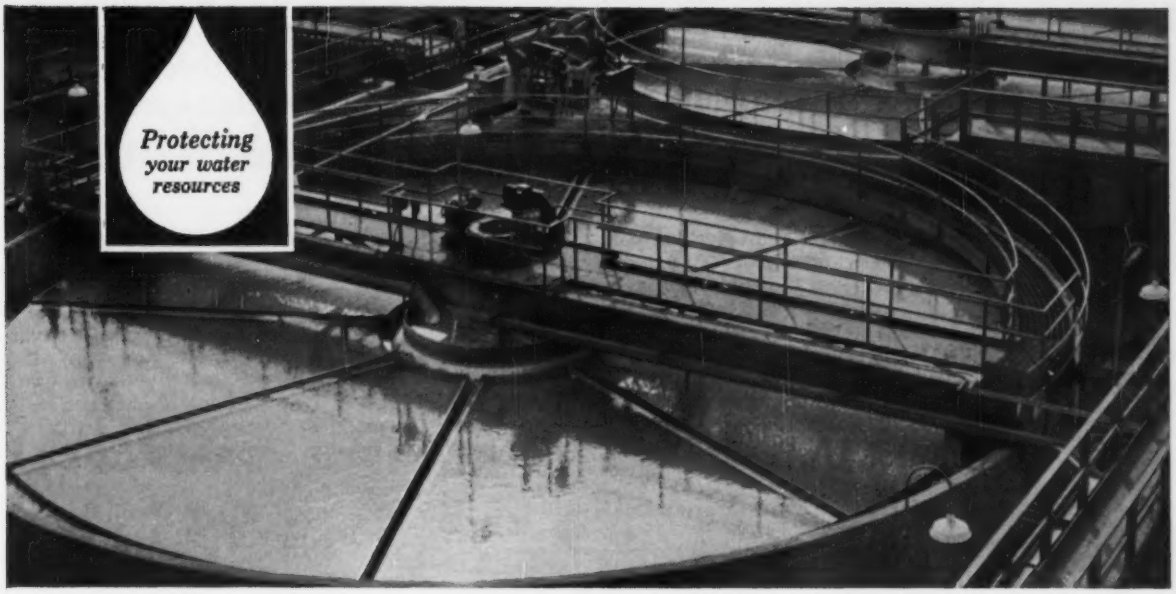
It pays to get your bits from this carbide manufacturer

V-R controls the manufacture of the entire bit —

1. Carbide inserts are quality controlled by V-R from ore to finished product.
2. Bits are brazed and finished by V-R to insure long life.
3. Bit body is made of high-alloy steel with precision threads to exacting V-R specifications.

These are reasons you get more clean, smooth, round blast holes with V-R Bits. Write Vascoloy-Ramet today regarding your requirements. Available through Authorized V-R Distributors, V-R Representatives or direct from the factory.





INDUSTRIAL WATER TREATMENT

LESS TROUBLESOME...LESS COSTLY

with EIMCO-PROCESS REACTOR-CLARIFIERS

Eight separate types of Reactor-Clarifiers have been developed by Eimco's Process Engineers Division, a type for any water treatment requirement from removing light turbidities or algae to the freeing of heavy suspended solids from industrial waste waters.

Because each type is specifically suited to a particular kind of treatment, ✱more effective performance is obtained, with reduced chemical and labor costs, and less "doctoring" to get an optimum reaction.

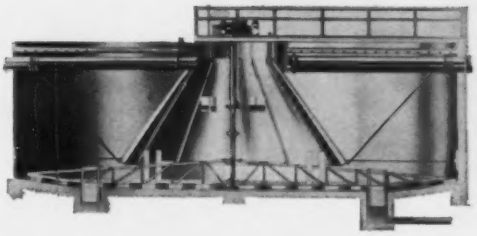
Eimco-Process Reactor-Clarifiers for high rate, standard rate or special purpose service can provide any combination of flocculation, coagulation, recirculation, aeration, softening, clarification and mechanical sludge removal in a single compact unit.

So that you may have all the facts about modern Reactor-Clarifiers in a convenient reference, we've prepared a new 24-page bulletin containing much valuable information. Get your copy of Bulletin SM-1006 from the Eimco-Process representative in your area. Or, write Eimco's Process Engineers Division.

✱*for example*

The Type HRB high rate solids-contact Reactor-Clarifier is a type highly effective for conditioning water from surface sources for process use.

High volume recirculation is achieved in a turbine reactor engineered to set up a flow pattern that results in repeated recirculation in the conical-shaped reaction compartment before the water enters a separate clarification compartment. The unique movement created by this mixing assures complete utilization of coagulating chemicals and less water in the withdrawn sludge. Variable speed operation gives this type Reactor-Clarifier exceptional sensitivity to varying influent characteristics.



Reactor-Clarifier is a trademark of The Eimco Corporation.

THE EIMCO CORPORATION
Salt Lake City, Utah

B-708

Process Engineers Division
420 Peninsular Avenue, San Mateo, Calif.

THIS IS MSA: Illumination • Electronic Communication and Control • Rock Dusting and Dust Collecting • Fire Fighting Equipment • Respiratory Protection • Artificial Respiration Equipment • Personal Protective Wear • First Aid Equipment • Permanent and Portable Instruments

Ore comes quicker with increased working light

Now Edison Model S Electric Cap Lamps give you *more* working light than any other cap lamp.

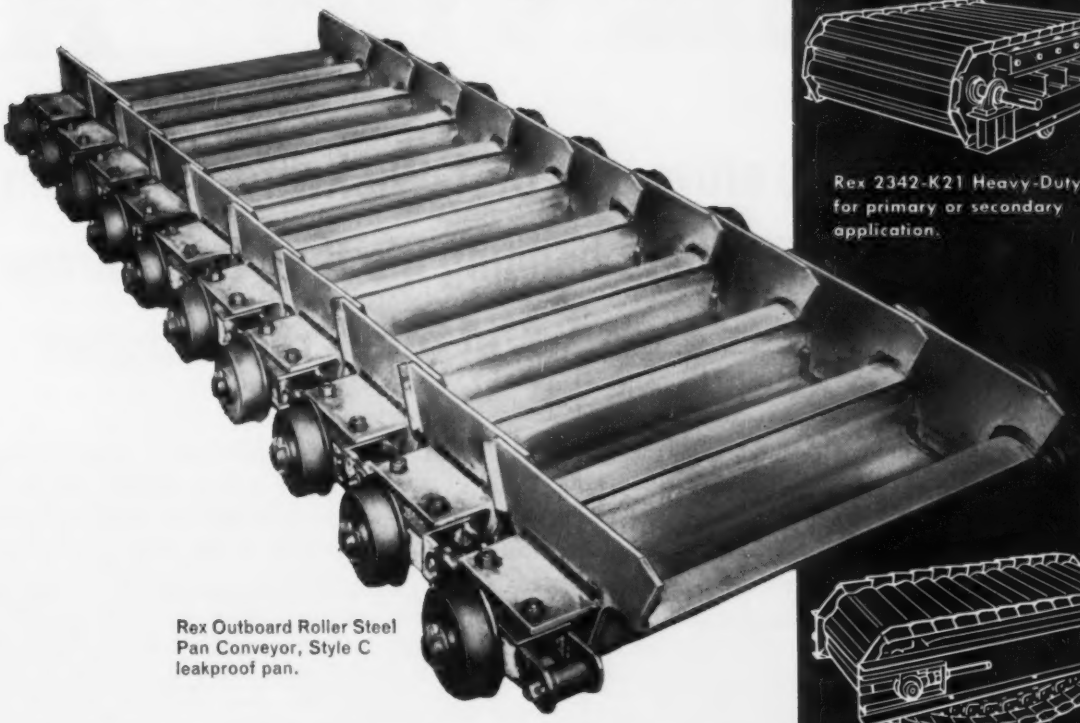
They're throwing *more* light on the subject of man-hour productivity, too. This is the safe lamp for the miner . . . the dependable lamp for you.

Miners themselves come up with the best reasons why: 15% increase in working light . . . small lightweight headpiece . . . 400 hours bulb life in each filament . . . longer battery life . . . clear, sharp spot every time . . . and so it goes.

As for charging: no new charging racks required . . . takes either constant current or constant voltage . . . over-charging or under-charging won't affect battery life . . . never a labor-scheduling problem.

Such an increase in working light can cast a favorable image on your operating sheet. Ask your MSA Representative about it. Mine Safety Appliances Company, Pittsburgh 8, Pa. In Canada: Mine Safety Appliances Company of Canada, Ltd., 500 MacPherson Avenue, Toronto 4, Ont. MSA

How to convey hot bulk materials with initial temperatures up to 1900°



Rex Outboard Roller Steel Pan Conveyor, Style C leakproof pan.

Rex Outboard Roller Steel Pan Conveyors provide a practical solution to many unusual conveyor problems.

Here are two of the ways improved Rex design gets right to the heart of the heat problem:

1. Chain and rollers are isolated from maximum temperature heat zone.
2. Carbon steel pans, with large pan surfaces, provide maximum heat transfer.

Long wear life, easy maintenance—Ruggedly built for extra stamina, Rex Outboard Roller Steel Pan Conveyors are known for their long, trouble-free service and low maintenance cost. Wear is confined to heavy outboard rollers; square through rods connecting the chains assure rigidity, equal load distribution; and outboard roller design permits easy servicing *without* disassembly of chain or conveyor.

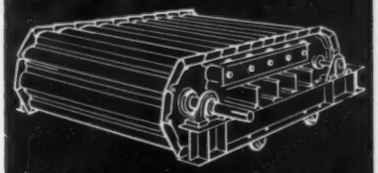
Preferred throughout industry—Deep pan construction, shown above, is ideally suited for use in a wide range of heat processing applications; for example: calcining, sintering, briquetting, beneficiating and nodulizing. This style is available in a wide range of sizes.

Other types available for every service—For information on how Rex Apron Feeders, Apron and Pan Conveyors can help you cut production costs, write CHAIN Belt Company, 4679 W. Greenfield Ave., Milwaukee 1, Wis. In Canada: CHAIN Belt (Canada) Ltd., Toronto and Montreal.

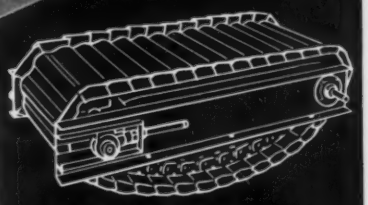
REX®

OUTBOARD ROLLER
STEEL PAN CONVEYOR

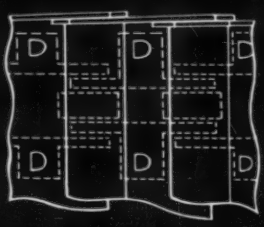
Types For EVERY Service

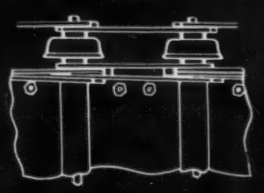


Rex 2342-K21 Heavy-Duty Feeder for primary or secondary application.



Rex 531-K17 Light-Duty Apron Feeder, used under hoppers and bins to regulate material flow.

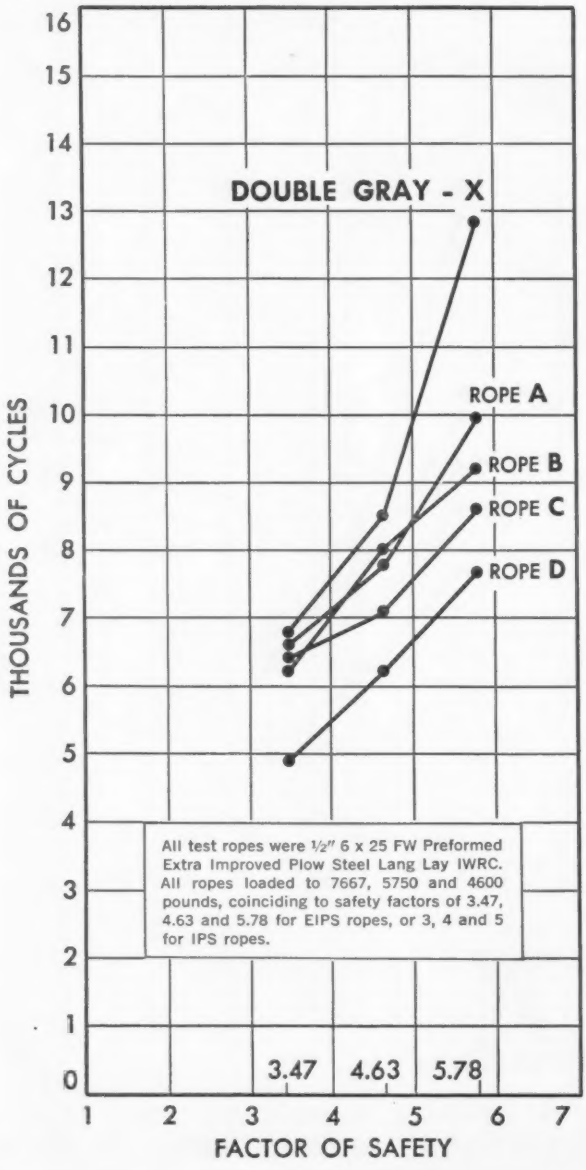




Style A aprons with Type K or A chain attachments furnished as machinery parts for many applications.

DOUBLE GRAY-X®

Laboratory tests prove that CF&I-Wickwire's premium wire rope has 45%* more bending life than the average of other ropes tested


DOUBLE GRAY - X
ROPE A
ROPE B
ROPE C
ROPE D
THOUSANDS OF CYCLES
FACTOR OF SAFETY
3.47
4.63
5.78
All test ropes were ½" 6 x 25 FW Preformed Extra Improved Plow Steel Lang Lay IWRC. All ropes loaded to 7667, 5750 and 4600 pounds, coinciding to safety factors of 3.47, 4.63 and 5.78 for EIPS ropes, or 3, 4 and 5 for IPS ropes.

The CF&I-Wickwire engineers who developed Double Gray-X *believed* in their product. So confident were they of its superiority that they decided to field-test prototypes of Double Gray-X as soon as they were perfected. In the months that followed, the top American firms chosen to participate in these tests delivered this verdict: when the going really gets tough, Double Gray-X lasts longer than other wire ropes.

Now, CF&I presents additional proof that Double Gray-X has *superior resistance to bending fatigue,* the chief enemy of wire rope life. In an extended series of tests conducted over the past year at CF&I's Palmer Plant, Double Gray-X proved itself superior to four other wire ropes, all made by major manufacturers.

HOW WERE THE TESTS CONDUCTED?

The five wire ropes tested—all identical in size and specification — all exceeded the catalog breaking strength of extra-improved plow steel ropes. Each rope was subjected to the same series of tests on a 25,000-pound, multiple-reeved fatigue machine, the largest of its kind. This machine punishes wire rope to destruction by bending it back and forth over sheaves.

*Percentage above average of all other wire ropes tested at safety factor of 5.78

lasts longer

WHAT WERE THE RESULTS OF THE TESTS?

As the chart indicates, Double Gray-X lasted longer than any of the four competing wire ropes at all the safety factors used in the test. At the highest and most commonly-used safety factor, Double Gray-X lasted 30% longer than the rope that lasted next longest, and 68% longer than the rope that lasted the shortest time. Double Gray-X lasted 45% longer than the average of all other wire ropes tested at this safety factor.

WHY DOES DOUBLE GRAY-X LAST LONGER?

It lasts longer because it's the result of a breakthrough in wire-drawing technique. This new process, which includes the use of molybdenum disulphide, creates these outstanding fatigue-resistance factors in Double Gray-X:

- **A Molecular Shield** – Molybdenum disulphide creates a shield around every wire, which serves as a lubricant and prevents the wires from grinding together as the rope operates. Less internal friction results in longer rope life.

- **Smoother Wire Surface** – CF&I's new wire-drawing technique helps eliminate minute surface imperfections in the wire. This smoother surface provides better resistance to fatigue.

- **Extra Toughness** – Molybdenum disulphide lubricates the wires during the drawing process. Since less power is required and less heat generated during this operation, the original toughness of the wires is better preserved.

WHAT CAN DOUBLE GRAY-X DO FOR YOU?

It can save you money. Because Double Gray-X lasts longer on even the toughest jobs, it cuts wire rope repair and replacement costs and rope-installation time. The net result to you is an overall reduction of costly equipment downtime, and a lowering of your total wire rope investment.

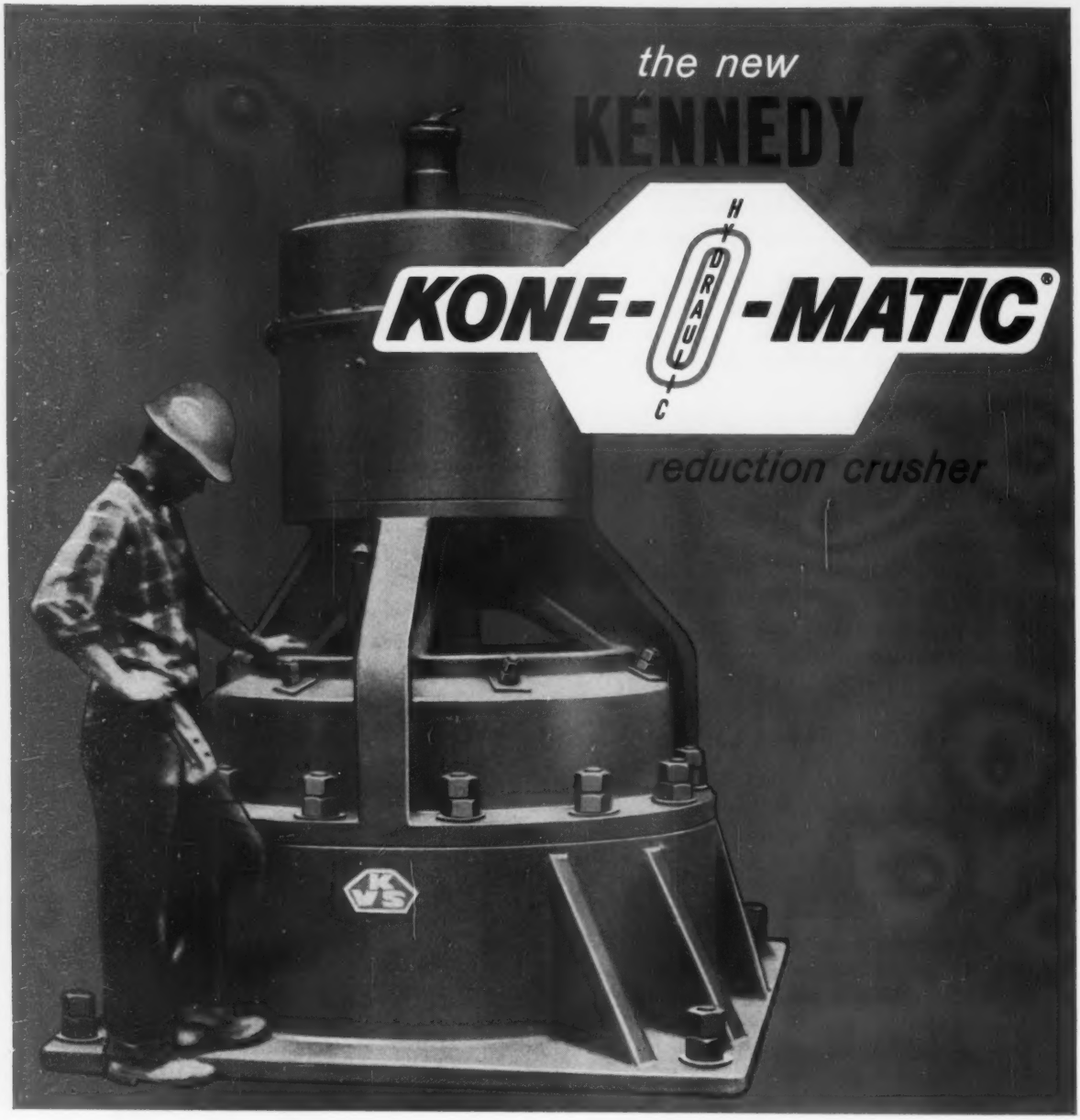
As a matter of fact, those of our customers who have already bought and field-tested Double Gray-X have reported considerably longer life and less downtime on their equipment. Join these satisfied customers—try Double Gray-X on *your* equipment right away. Ask your CF&I salesman to give you complete details on these tests.

The Colorado Fuel and Iron Corporation

DENVER • OAKLAND • NEW YORK

SALES OFFICES IN ALL KEY CITIES

6180



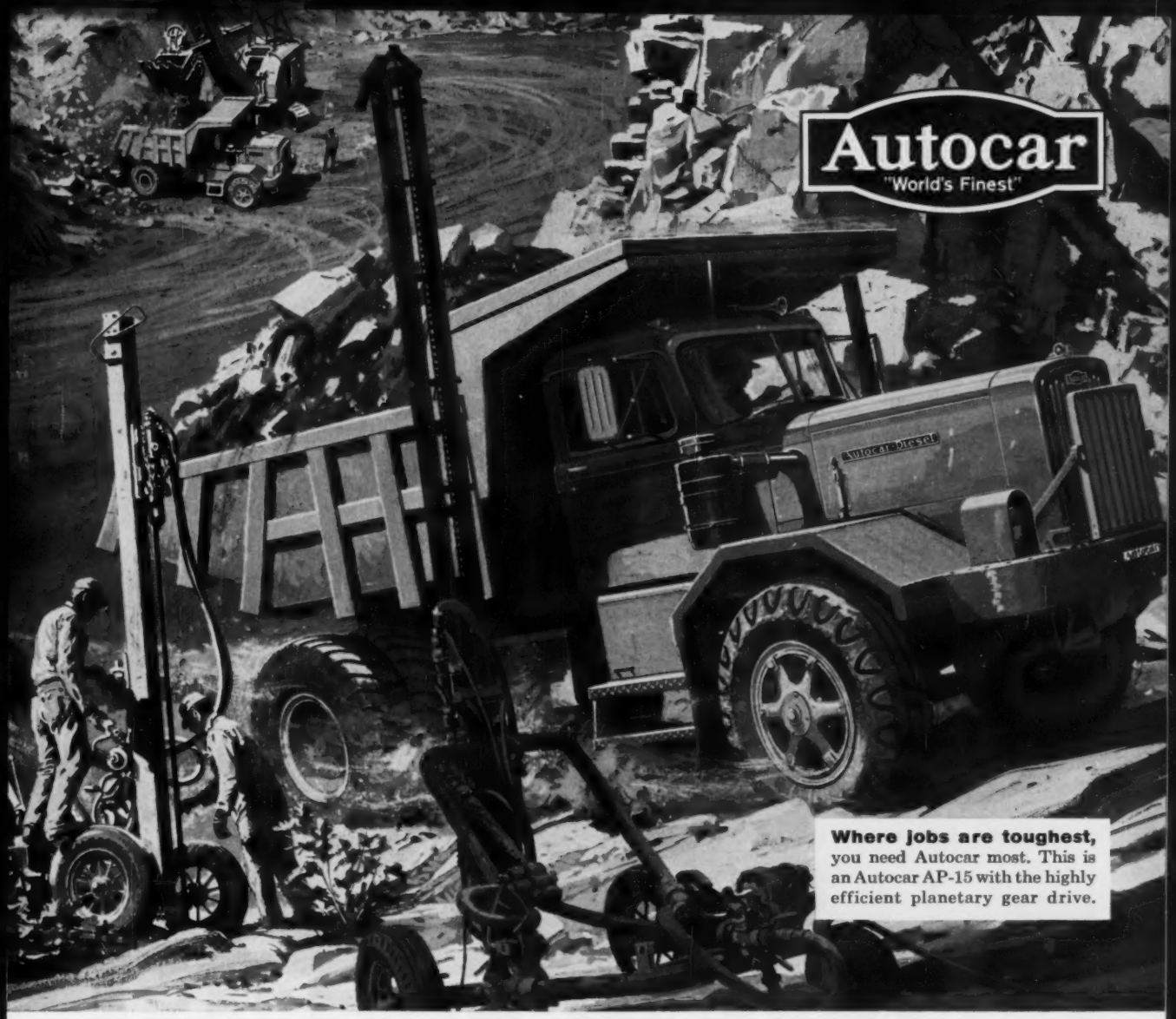
- **With the *KONE-O-MATIC* Crusher, setting is sensed and held in position automatically by a multi-piston, fully hydraulic suspension system!**
- **Tramp iron is automatically released and *KONE-O-MATIC* is back to its setting *fast*, with no strain, shock, bump or damage!**
- **Setting can be changed instantaneously by finger-tip control without shutdown!**
- **And the new *KONE-O-MATIC's* feed opening is lower and larger, size for size, than any other crusher we know of!**

These, and many other exclusive features, add up to more productive hours per year, and therefore, more output; to fewer operating headaches; to a more evenly sized product; and best of all, you'll save on overall operating cost! This has been proven in actual quarry operations! We know you'll like the *KONE-O-MATIC!*

Send today for the new KENNEDY KONE-O-MATIC Bulletin, KOM-61.

KENNEDY VAN SAUN
MANUFACTURING & ENGINEERING CORPORATION
405 PARK AVENUE, NEW YORK 22, N.Y. • FACTORY: DANVILLE, PA.

Primary & Secondary Gyratory Crushers • Jaw Crushers • Roll Crushers • Impact Breakers • Hammer Mills • Rod, Ball & Tube Mills • Rotary Kilns & Kiln Accessories • Dryers • Scrubbers • Screens • Pneumatic & Mechanical Conveyors • Complete Crushing, Lime, Cement & Carbon Paste Plants • Research & Testing Services.



Where jobs are toughest, you need Autocar most. This is an Autocar AP-15 with the highly efficient planetary gear drive.

"Heavy hauling's for Autocar . . . not a substitute"

Need a truck that's versatile, tough under punishment, ready to do any kind of heavy job in any kind of weather? That's the kind of work for an Autocar AP-15.

This Autocar is at home on slippery shale rock; in deep, rutted mud; up grades that look impossible. That's because—with its planetary rear axle—the power is applied with greater gear reduction directly to the rim of the wheel.

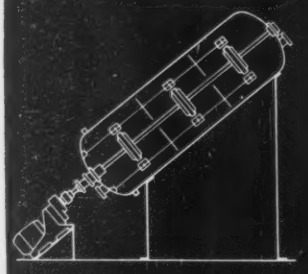
Here's a truck plenty tough for anything that comes. It is constructed throughout—from bolted double frame to double-bottom body—to take the heavy shocks and jolts of the day's work.

Each Autocar is custom-engineered to order. Operators agree, Autocar is the "World's Finest." Why try to get along with less? White-Autocar comprehensive service throughout the United States.

Autocar
"World's Finest"

Division of
The White Motor Company
Exton, Pa.

FIRST in the FIELD



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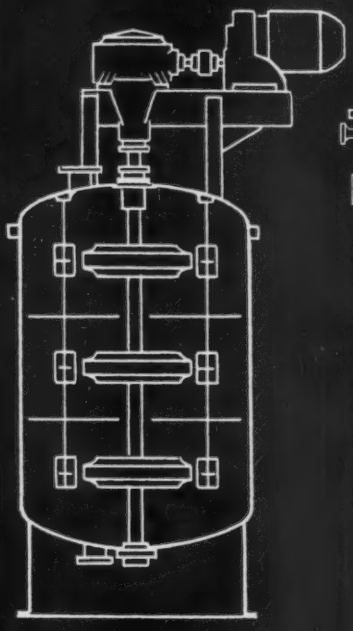

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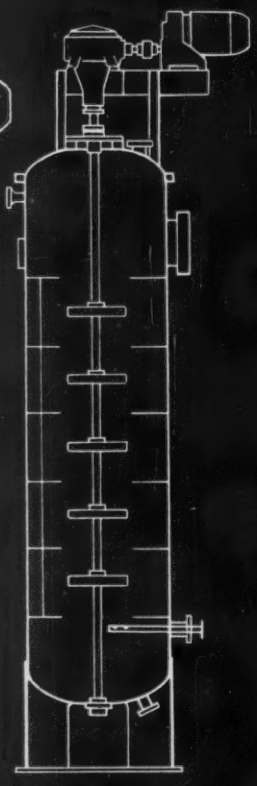

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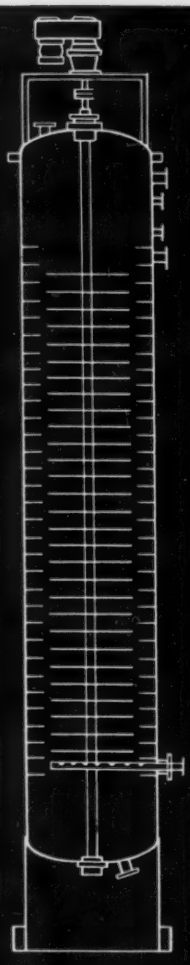


4

1 First staged mixer (1933) supplied to industry. Designed and built by Turbo-Mixer.

2 Standard 3 stage concurrent mixer, supplied by Turbo-Mixer since 1935.

3 Concurrent or countercurrent Turbo-Mixer reactor built in any size or number of stages.

4 RDC* column built by Turbo-Mixer. Latest word for countercurrent extraction.

STILL 1st WITH THE BEST

Staged mixing equipment is an old and continued story with Turbo-Mixer. From the first staged mixer, patented in 1933, through constantly improved concurrent and countercurrent equipment to the Rotating Disc Contactor, the staged mixing and extraction equipment preferred in most industries, General American's Turbo-Mixer Division has led the way. You may be sure General American research and industrial knowhow will maintain this leadership.

Write for Bulletins #T-11 and #T-1159 for descriptive details!

Process Equipment Division—Turbo-Mixers

GENERAL AMERICAN TRANSPORTATION CORPORATION

135 South LaSalle Street
Chicago 3, Illinois

TURBO-MIXER GENERAL AMERICAN TRADE MARK

Offices in principal cities

TYLER OFFERS UNIQUE TECHNICAL SERVICE IN SCREENING

An abrasive manufacturer wanted to know how to separate his raw material in several different grit sizes—sent a sample to the Tyler Customer Service Laboratory. Here the material was separated on production-size vibrating screens, with a variety of wire cloth types, permitting positive recommendations on equipment and wire cloth for each specification desired.

This type of technical service will help you obtain—in your own plant—the lowest possible screening cost. Call Tyler for help on your separation problems. From thousands of types of Tyler woven wire cloth, we can recommend the right type for your requirements.

Standard of the world Tyler Standard Testing Sieves are recognized world-wide as the standard for classification of granular materials. This testing equipment tells you what sizes are present in raw materials, relative proportions, and helps you meet specifications and control quality.

TYLER CUTS YOUR COST OF SCREENING

• Requirements matched from world's broadest line of wire cloth • Fast shipments from the industry's largest inventory • Technical service backed by unique Customer Service Laboratory.

TYLER

THE W. S. TYLER COMPANY *Cleveland 14, Ohio* • OFFICES: Atlanta • Boston • Chicago • Dallas • Los Angeles • New York • Philadelphia Pittsburgh • Salt Lake City • San Francisco • The W. S. Tyler Company of Canada, Limited, St. Catharines, Ontario • OFFICE: Montreal

LE ROI LRD-3 for powerful, deephole rotary drilling

Here's the *big* rig . . . completely self-contained for putting down hole as large as 7⅞ in. to 100 ft. depth!

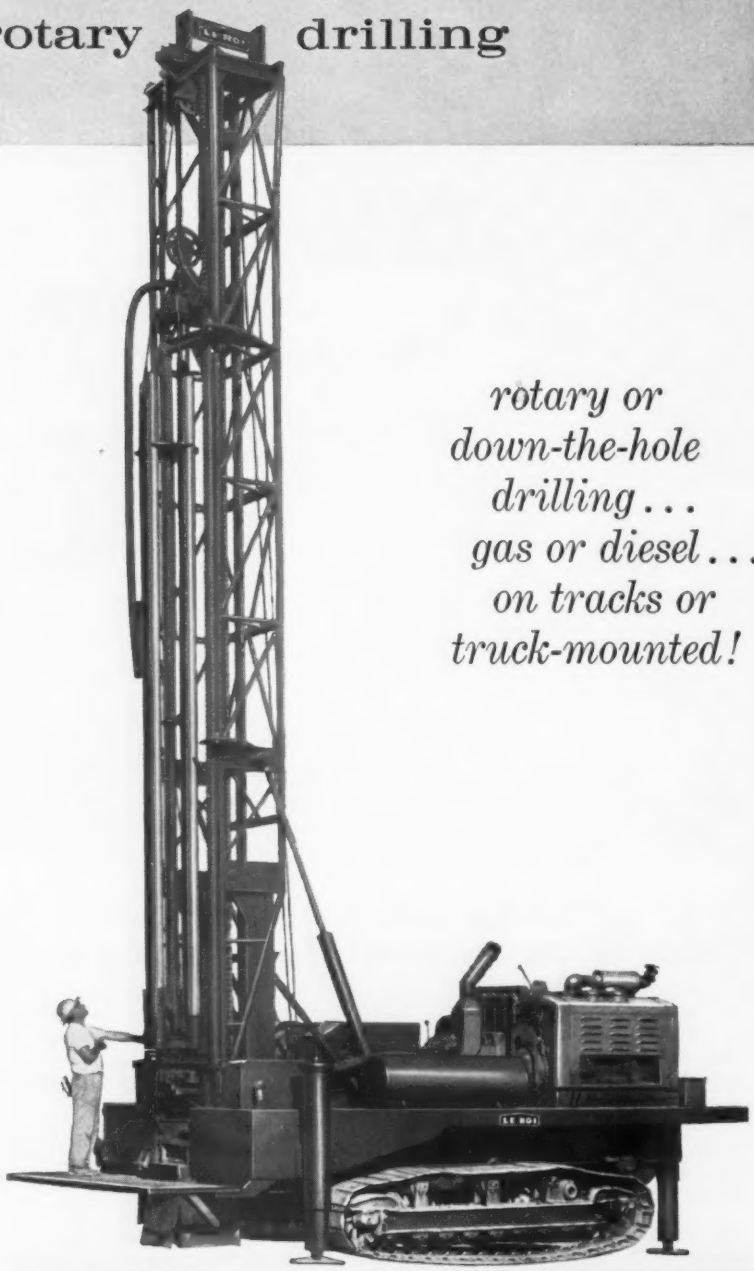
The LRD-3 is available with either crawler or truck mounting. An enclosed cab can be furnished to provide all-weather protection for the operator while drilling. All controls are conveniently grouped for easy operation and good visibility.

The traveling head design of the LRD-3 provides positive mechanical power without excessive torque loss under heavy pulldown, and permits easy control in making up and breaking down drill pipe. Every function of the unit is designed to speed productive drilling and keep the operator making hole. Leveling, raising the mast, and even the automatic drill pipe magazine are hydraulically controlled for speedy operation. A powerful dust collector traps cuttings and blows them well away from the unit.

An extra-sturdy 4-speed chain-hydraulic pulldown puts up to 30,000 lbs. of pressure on the bit of the LRD-3. A rugged dual-range transmission provides rotary speeds from 9 to 168 rpm in a selection of 10 forward and 2 reverse speeds.

Where needed, the rotary bit can be quickly changed for a powerful down-the-hole drill. A Le Roi 100 hp dual-manifold air compressor provides plenty of 100 psi air for punching through tough rock with the down-the-hole drill, or it can be set to deliver 625 cfm of 40 psi air for fast, efficient removal of cuttings in rotary operation.

The LRD-3 comes complete with a hydraulically operated magazine with capacity for four 20 ft. drill pipes, and can be equipped with such optional equipment as lights for night-time operation, a mounted bit grinder, air hoist, breakout tongs, water injection system, etc. Specification Sheet AT-147 describes the unit in detail, with complete spec information. Send for a copy.



rotary or down-the-hole drilling . . . gas or diesel . . . on tracks or truck-mounted!

LE ROI

division of Westinghouse Air Brake Co. Sidney, Ohio

It's Here... The First COMPACT IN PUMPING

FLYGT® Bibo 3"

ELECTRIC SUBMERSIBLE

CHECK THE FACTS . . . ! ! !

You can't discount experience, satisfied users or mounting sales. The world's first submersible "dirty water" pump was designed by "Flygt" in 1946. Ever since, thousands of customers the world over are relying on economical "Flygt" performance. Recently competition has followed the lead established by "Flygt", confirming the superiority of in-the-water pumps. Advanced research, imaginative engineering and manufacturing know-how plus 15 years of field testing result in "Flygt" quality. There's a "Flygt" for every job - 1½" to 8". **NOW** the **NEW** Bibo 3" COMPACT, weighing only 88 lbs., delivers 20,000 GPH. Only "Flygt" could offer you a pump like the Bibo 3". Do yourself a favor, see it in action on your next job. One more important point . . . priced to greatly reduce pumping costs.

87-19

Available in 220-440v and 550v. Also 220v single phase

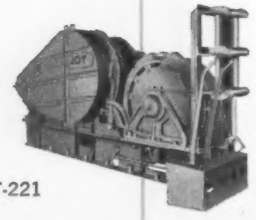
RIGINAL MANUFACTURERS OF ELECTRIC SUBMERSIBLE 'DIRTY WATER' PUMPS!

FLYGT Corporation HOOSICK FALLS, N. Y.

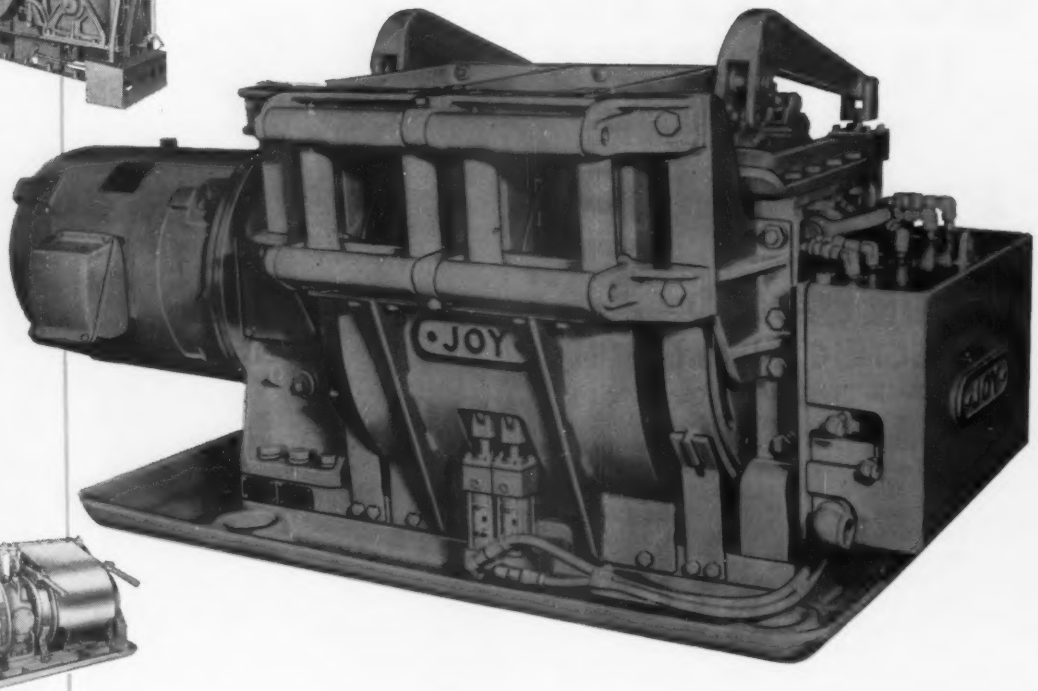
WESTERN SALES & SERVICE: STANCO MFGS. & SALES INC., 1666 Ninth St. (Corner of Olympic) Santa Monica, Calif. • IN CANADA: FLYGT CANADA LIMITED, Montreal, P. Q.

PUMP BETTER ELECTRICALLY, USE FLYGT!

JOY HAS THE RIGHT SLUSHER FOR THE JOB



XT-221



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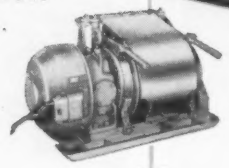


FF-211

Model No.	Horsepower
S-211	5 hp
FF-211 & FF-311	7½, 10, 15 hp
A2F-211 & A2F-311	15, 20, 25 hp
B2F-211 & B2F-311	20, 25, 30, 40 hp
C2F-211A & C2F-311A	50, 60, 75 hp
R-221 & R-222	100, 125 hp
RF-211-212	100, 125 hp
XT-221 & XT-222	150 hp

With a complete line of job-rated slushers, Joy can recommend the proper unit to do the job efficiently. For true economy on the small jobs, Joy offers the S-211 and FF-211 line in sizes from 5 to 15 horsepower. These units are air or electric driven and extremely compact for portability underground.

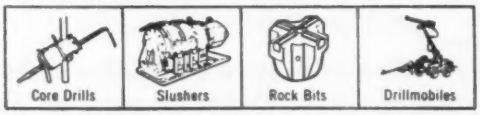
For medium capacity, Joy builds A and B class slushers from 15 to 40 hp. These two and three drum slushers are designed to handle the bulk of scraping jobs.

Three larger units in the "C" series go up to 75 hp for the heavy-duty jobs where portability is still required. For the largest semi-permanent installations, Joy builds large capacity slushers from 100 to 150 horsepower.

With more than 300 types and sizes of hoists and slushers to choose from, there is not a scraping job that can't be handled most efficiently with a Joy unit. Call in a Joy engineer for the size and type to suit your scraping jobs or write for bulletin 950-4.

EQUIPMENT FOR MINING...FOR ALL INDUSTRY

JOY



Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

NEW

engine power
BY CATERPILLAR

NEW KW

NEW HP

CAT D343
gives you outstanding performance at an unmatched price per horsepower

Turbocharged-Aftercooled D343 provides 420 HP maximum at 2000 RPM, electric set produces up to 250 KW.
Turbocharged only—360 HP maximum with electric set ratings to 200 KW.

CHECK ALL THESE MONEY-SAVING ADVANTAGES:

SUPERIOR FUEL ECONOMY
- As low as 0.387 lbs. per brake horsepower hour

OUTSTANDING PERFORMANCE
- 420 HP maximum . . . up to 250 KW
- Modern design . . . Turbocharged and Aftercooled
- Four valves per cylinder with individual porting
- Precise valve action with twin overhead camshafts
- Complete combustion through four-cycle design . . . full stroke power

LOW OPERATING COSTS
- Foul-free operation . . . large single-orifice fuel injectors
- Efficient burning of wide range of fuels because of pre-combustion chamber design

LONG LIFE
- Performance-proved Caterpillar-quality components
- Maximum cooling efficiency . . . wet-type cylinder liners, constant-spray-cooled pistons, high water-flow head
- Large-capacity dry-type air cleaner . . . double oil and fuel filtration systems

EASE OF SERVICE
- Tinker-free fuel system . . . no adjustments needed
- No valve train mechanism with twin overhead camshafts

All Caterpillar Engines are backed by over 800 sales, parts and service outlets throughout the Free World. Call your Caterpillar Dealer or write us direct for complete specifications on the new D343.

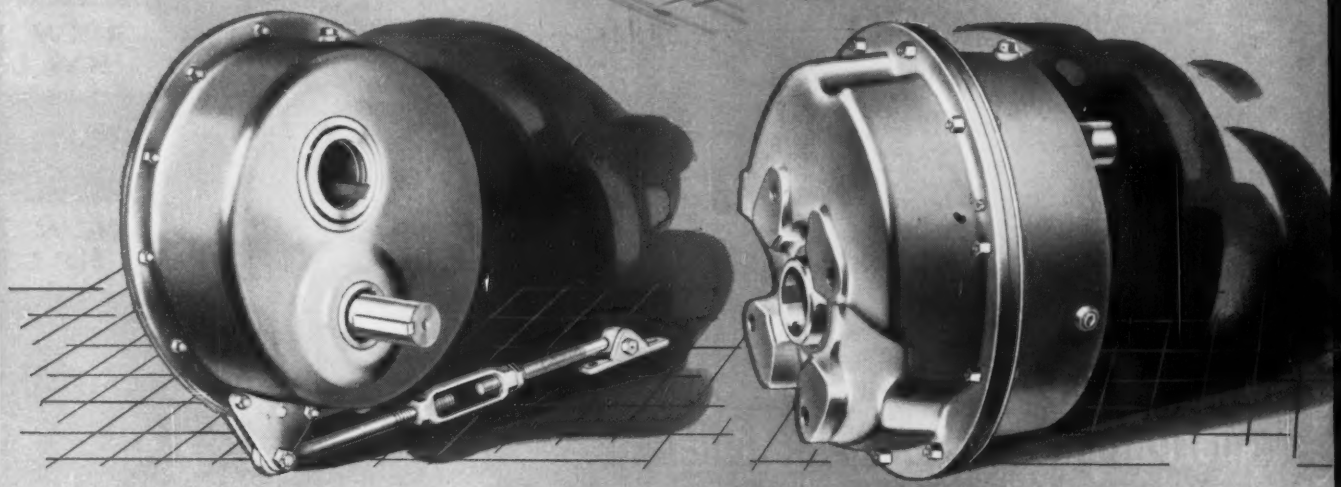
CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

Caterpillar Tractor Co., Engine Division, Peoria, Illinois, U. S. A.

FALK

A GOOD NAME IN INDUSTRY



Ask for Bulletin 7100

Ask for Bulletin 7100

147 COMBINATIONS . . . horizontal or vertical applications . . . . . .

UNIT SIZE	SHAFT MOUNTED DRIVES					
	RATIOS			MOTOR MOUNT	OVERLOAD RELEASE	BACK-STOP
	4	14	24*			
107J	X	X	X	X	X	X
115J	X	X	X	X	X	X
203J	X	X	X	X	X	X
207J	X	X	X	X	X	X
215J	X	X	X	X	X	X
307J	X	X	X	X	X	X
315J	X	X	X	X	X	X
407J		X	X	X	X	X
415J		X	X	X	X	X
507J		X	X	X	X	X

½ to 125 hp. Up to 100,000 lb-in. torque

UNIT SIZE	FLANGE MOUNTED DRIVES					
	RATIOS				BACK-STOP	MOTOR MOUNT
	4	9	14	24*		
107J	X	X	X	X	X	X
115J	X	X	X	X	X	X
203J	X	X	X	X	X	X
207J	X	X	X	X	X	X
215J	X	X	X	X	X	X
307J	X	X	X	X	X	X
315J	X		X	X	X	X
407J			X	X	X	X
415J			X	X	X	X
507J			X	X	X	X

*20:1 ratio for sizes 107 and 115

½ to 125 hp. Up to 100,000 lb-in.

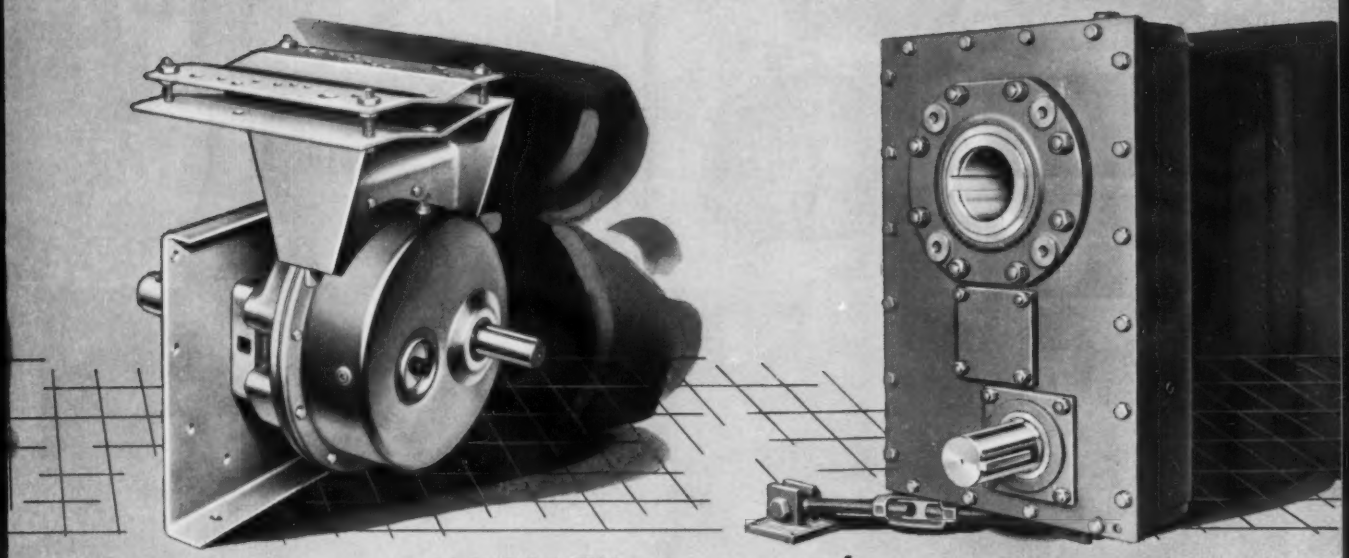
Exclusively **FALK**.. ***Adaptability of all these three types of Falk Drives for use with Equi-Poised Motor Mount.*** **This feature reduces costs of engineering and constructing motor bases and foundations.**

Exclusively **FALK**.. ***Interchangeable rotating elements*** **size-for-size between Shaft and Flange Mounted Drives or Screw Conveyor Drives. This feature simplifies stocking and maintenance for large users.**

. the most complete line of

SHAFT MOUNTED, FLANGE MOUNTED and SCREW CONVEYOR drives . . .

The line with the exclusive EQUI-POISED motor mount



Ask for Bulletin 7106

. . . . . AVAILABLE FROM STOCK

UNIT SIZE	SCREW CONVEYOR DRIVES				
	RATIOS				MOTOR MOUNT
	4	9	14	24*	
107J	X	X	X	X	X
115J	X	X	X	X	X
203J	X	X	X	X	X
207J	X	X	X	X	X
215J	X	X	X	X	X
307J	X	X	X	X	X
315J	X		X	X	X
407J			X	X	X
415J					
507J					

½ to 40 hp. Up to 44,000 lb-in. torque

Exclusively **FALK** . . . ***Single helical gears*** **used in *all* sizes and types—they provide maximum (98½%) efficiency per gear mesh.**

FALK is a registered trademark

New 2 LARGER SIZES OF SHAFT MOUNTED DRIVES—415-507

Falk-designed and Falk-built for higher torque requirements, these all-steel, *helical* gear reducers are available in Shaft and Flange Mounted Drive design.

TWO RATIOS, 15:1 and 25:1
HORSEPOWER RATINGS TO 125
TORQUE RATINGS TO 100,000 LB-IN.

Ask for **Bulletin 7100.1 (Shaft and Flange Mounted Drives) or for Bulletin 7106.1 (Screw Conveyor Drives).**

THE FALK CORPORATION
MILWAUKEE 1, WISCONSIN

Manufacturers of Quality Gear Drives and Flexible Shaft Couplings

Representatives and Distributors in most principal cities

A POINT TO PONDER . . . when you need gear drives or shaft couplings of "FALK OR EQUAL" quality, where but from Falk can you get the "OR EQUAL"?

Now, load faster, more safely than ever before...

NEW GARDNER-DENVER "WORK

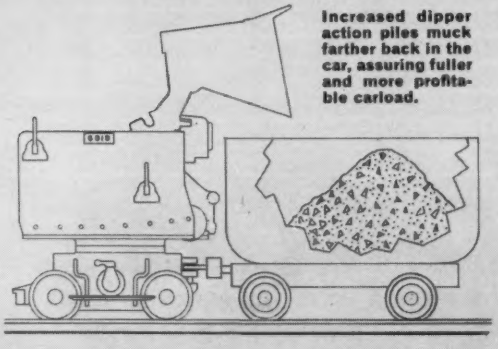
MODEL GD18

Controls for traction and dipper action placed for ease of operation—no mechanical linkages.
Chain equalizer bar shaft
Full 9-cu.-ft. dipper capacity.
Heavy-duty, rugged, positive clutch.
Upper deck pivots on tapered roller bearings.
GARDNER-DENVER

SPECIFICATIONS

Clean-up width	105″
Track gauge	18″ to 36″
Weight—Standard	7530 lb.
High	7950 lb.
Dipper capacity	9 cu. ft.
Traction motor hp	15 at 90 psi
Dipper motor hp	17 at 90 psi
Necessary air pressure	50-100 psi
Size air connection	1½″

MORE PAY LOAD



Increased dipper action piles muck farther back in the car, assuring fuller and more profitable carload.

HORSE" MINE CAR LOADER

4 BIG REASONS WHY THE GD18 IS YOUR BEST BUY—ANYWHERE

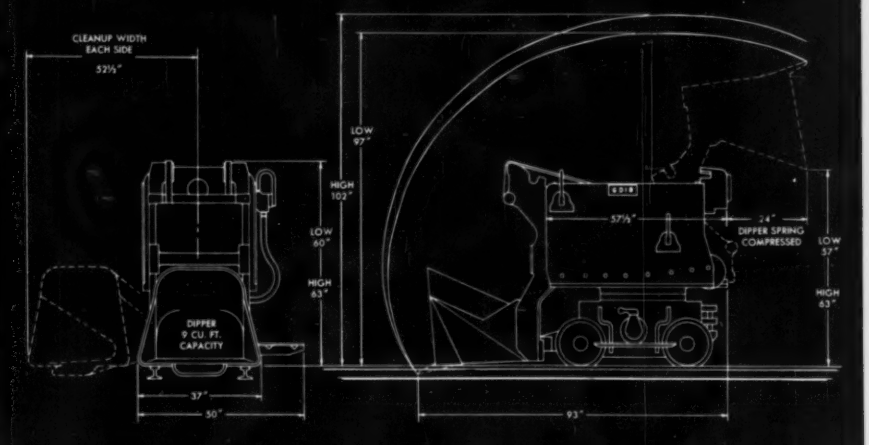
MORE POWER—Highly increased dipper and traction motor hp. And you can use every bit of it. Weight distribution and force leverages are balanced with this extra hp.

UNMATCHED PERFORMANCE—Faster loading rate per car—proved by actual competitive tests in iron ore at any pressure from 50 to 100 psi. You get more tons per carload—increased dipper power throws muck peak farther back in the car.

PROVED RELIABILITY—Years of extensive field testing *proved* the design . . . *proved* low operating and maintenance costs . . . *proved* increased production with fewer delays.

MAXIMUM SAFETY—Excellent weight distribution provides stability regardless of track gauge—better than any other loader. Reliable centralizing and minimum effort, required to position dipper, safeguard operator . . . enable him to get high performance with ease.

DIMENSIONS



OTHER FEATURES

- Smooth, positive centralizer action
- Easily converted to high or low construction
- Traction and dipper motors have same internal parts
- Five-cylinder radial air motors
- Three-point lubrication
- Crown-shaved gears
- Single, enclosed shock spring for dipper
- Steel wheels
- Unitized component assemblies—interchangeable
- Self-cleaning dipper arm guides

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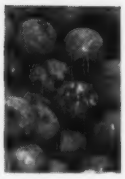
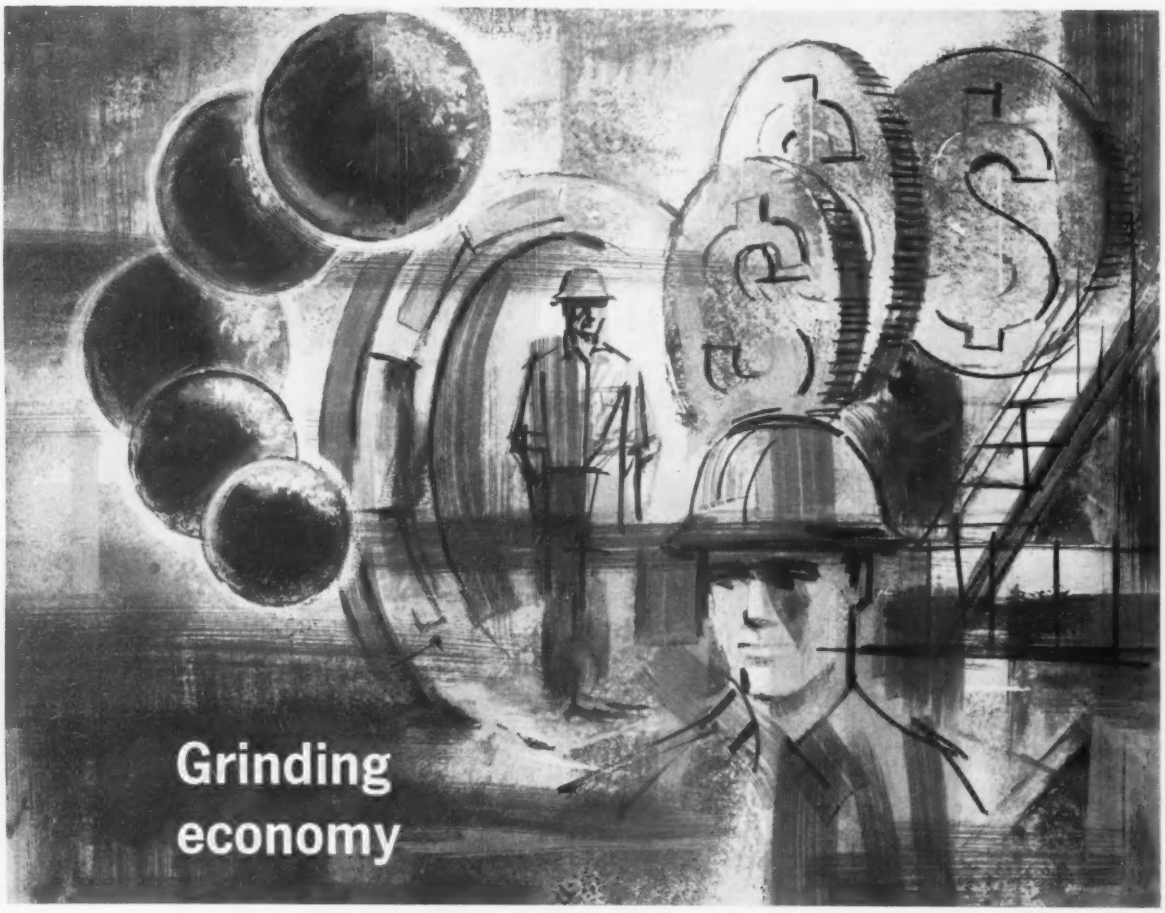
Strong
Tough
Economical
Efficient
Lasting

Steel



SHEFFIELD MOLY-COP Grinding Balls



has earned customer acceptance Over a million tons of Sheffield Grinding Balls have proved that Moly-Cop quality will give you better grinding at lower cost. What's behind this fine performance? Hardness, toughness and uniformity. Hardness to fight wear. Toughness to resist spalling and breaking. And uniformity of fine grain structure right to the core. That's why Moly-Cops keep their spherical shape longer, require fewer chargings and less down time, and save you money in the long run. **Sheffield Plants: Houston, Kansas City, Tulsa.**

ARMCO Sheffield Division

ASEA's new multi-rope friction mine hoists for installation in one of the largest mines take an unbalanced load of 55 tons at a speed of 2760 feet per minute—twice the load of any known hoist at this record speed.

Here are two major advantages of these new mine hoists pioneered by ASEA for mine owners everywhere.

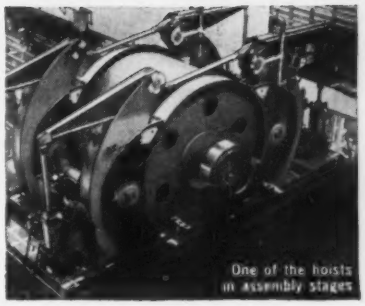
1 MULTI-ROPE FRICTION DRIVE; this enables a moderate sized pulley (length, 7'2", diameter, 12'2") to take a very high unbalanced load with ease.

2 FULLY AUTOMATIC OPERATION, which can save as much as $30,000 a year per hoist at prevailing U.S. wage rates, assuming two-shift operation.

Make profitable use of ASEA design and engineering experience. Let ASEA save operating costs—in a big way just as it saves for 14 U.S. and Canadian mining companies. Write for literature to: ASEA ELECTRIC INC. 500 Fifth Avenue, New York 36, New York and 55 New Montgomery Street, San Francisco 5, California.

TECHNICAL DATA

Hoisting	Double Skip	Hoisting speed	2760 ft. per min.
Hoisting capacity	1400 tons per hour	Number of ropes	8
Net load	55 tons	Rope Diameter	1¾"
Skip weight	44 tons	Diameter of Pulley	12'2"
Depth of shaft	3940 ft.	Length of Pulley	7'2"
		Motor output	12,000 h.p.


One of the hoists in assembly stages

Mammoth Coal Co. chose Haulpaks® for:

① more trips per day
② lower maintenance costs

Take it from Mammoth Coal Co., of Raven Run, Pennsylvania... one of the surest... and quickest ways to reduce off-road hauling costs is to use LeTourneau-Westinghouse Haulpaks. Here, Mr. Walter C. Bohler, shop foreman for Mammoth Coal, tells you why.

"Our operation here at Mammoth Coal is tough on trucks. This anthracite coal weighs 1800 lbs per yd, and overburden (mostly rock), 2600 lbs per yd, so when our 6-yd shovel drops a dipperful into a truck, it's quite a jolt. And our trucks work 13½ hours a day, loading in restricted areas, hauling capacity loads up to 7 miles with grades to 13%.

"How have our two 32-ton Haulpaks been performing?... Well, we find operating expenses *greatly reduced.* One of our Haulpaks has run 400 hours without even a body dent... the other has needed only minor repairs. We will also save money when servicing these units, because they have *fewer components* than our other trucks of similar capacity. In addition, the Haulpaks use less fuel — *20 gallons less per 7-hour shift!*

"Another important Haulpak advantage we like is its short turn radius. Since our trucks usually have to load in narrow areas between steep pit walls, we find Haulpaks can get in-and-out of loading areas with no time wasted jockeying back-and-forth. This saves us valuable time and permits our Haulpaks to complete as many as *3 extra cycles per day!*"

TWO MORE LW Haulpaks were delivered to Mammoth Coal at the time this report was ready for printing. Further proof of satisfied performance! Mammoth's new Haulpaks have 550 hp, 60-ton capacity.

Mammoth's 6-yd shovel loads Haulpak with capacity load *fast.* V-body gives you bonus yardage within an exceptional short wheelbase. Maneuverability: 32-ton Haulpak makes 180° turn in area only 44'6" wide.

Another load of overburden at Mammoth Coal Co. is dumped in a hurry! Haulpak's twin 3-stage hoists lift body in seconds to a high angle for fast, complete ejection of load. Body is exhaust heated, prevents materials from freezing and sticking. There's no load "carry-back" problem with Haulpak.

32-ton Haulpak highballs load over mine road for Mammoth Coal Company. LW's exclusive Hydrair® suspension cushions against loading and travel shock . . . keeps unit riding level.

Want to learn how LeTourneau-Westinghouse Haulpaks give you lowest net cost per ton-mile? We'll be happy to show you! Five sizes, 22 to 60 tons, up to 550 hp. Ask to see our 15-minute film, "Revolution on Wheels". No obligation.

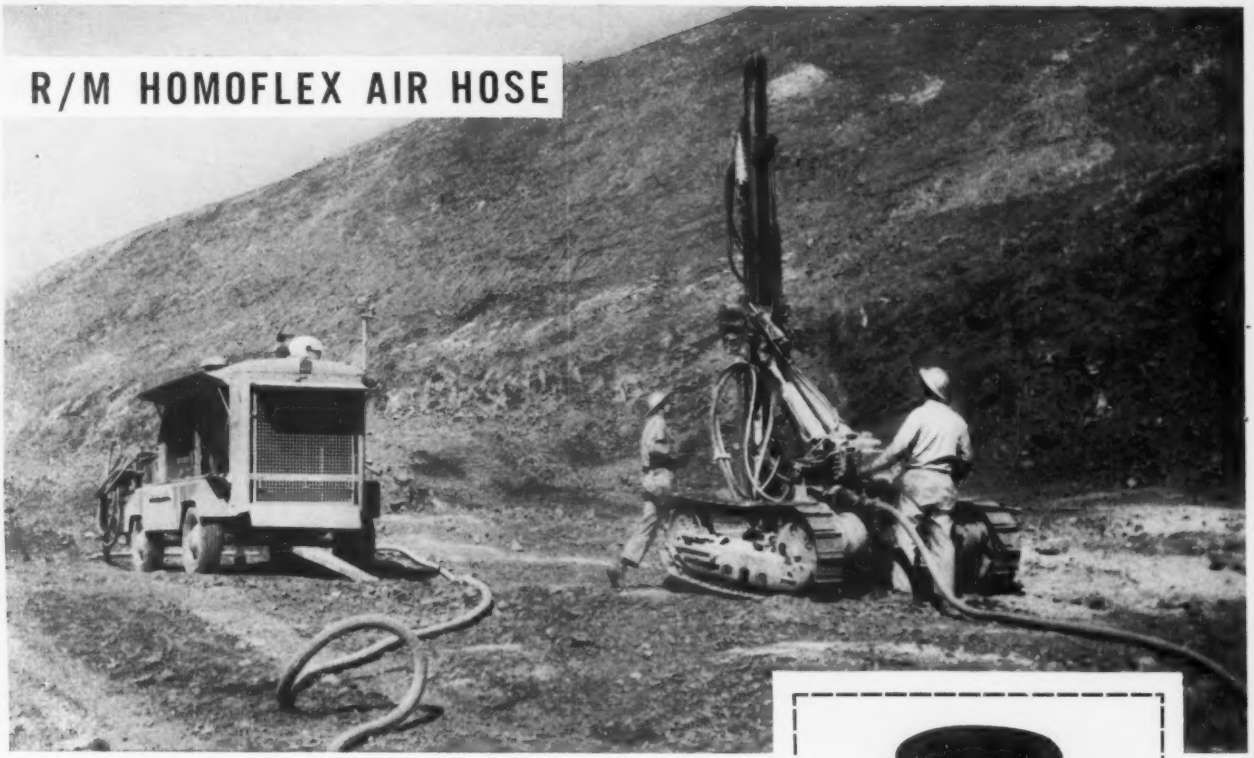
HP-2302-MJ-2

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

LW®

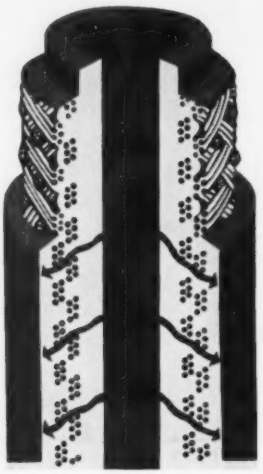


Flexible as a Rope...
HOMOFLEX Handles Easier, Lasts Longer in Rugged Work

Only Raybestos-Manhattan offers unique Homoflex construction —to produce a hose that is super-strong yet flexible . . . and weighs less than any other air hose of equal working pressure.

- **SUPER-STRONG**—assures longer, trouble-free service life
- **PRECISION BUILT**—with super-strength, low-stretch cords
- **MANDREL-MADE**—no pre-set twist
- **KINKLESS**—coils and uncoils freely in any direction
- **HOMOGENEOUS CONSTRUCTION**—provides inseparable tube-to-cover bond
- **SAFER, EASIER TO COUPLE**—inside and outside diameters are uniform

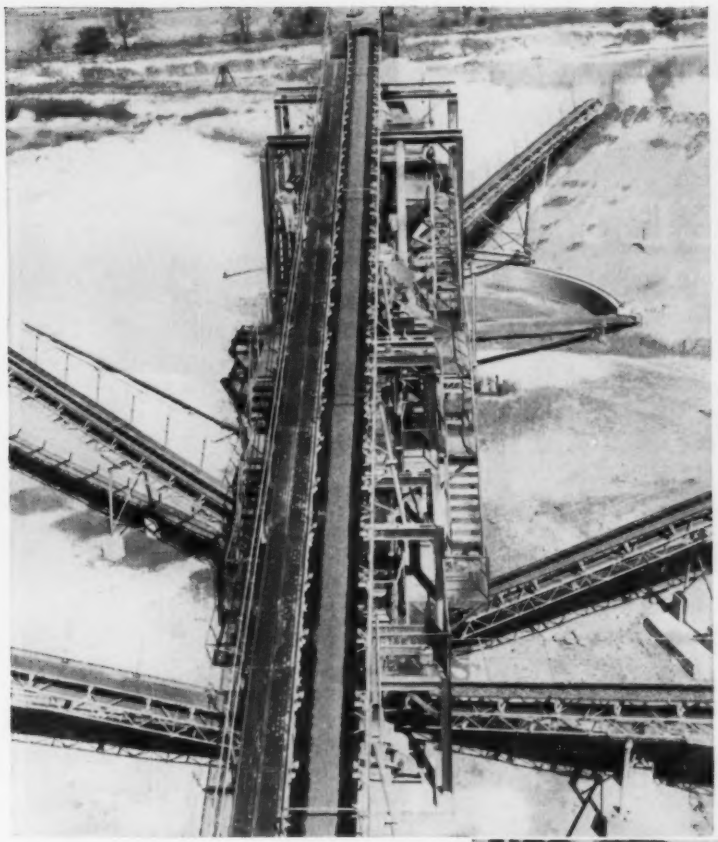
Homoflex H. D. Air Hose is also available for extra heavy duty and with *yellow cover stripe* for visibility; also in type for water in mine use. Let your R/M distributor show you how to get More Use per Dollar with R/M hose. Write for Catalog M5.



EXCLUSIVE HOMOFLEX CONSTRUCTION makes strength member and tube virtually inseparable for long, trouble-free service. Uniform inside and outside diameters permit faster, safer, easier coupling—faster, fuller flow.

STRONG—LIGHT—KINKLESS

RAYBESTOS-MANHATTAN, INC.
MANHATTAN RUBBER DIVISION • PASSAIC, N. J.
ENGINEERED RUBBER PRODUCTS



RAY-MAN Conveyor Belt

Troughs Deeper, Trains Easier

Ray-Man construction meets the performance requirements for Cantwell Machinery Company conveyors at Marble Cliff Quarries Company's Arrow Sand and Gravel Plant, Columbus, Ohio. Ray-Man has the flexibility and troughability to haul fuller loads—even with small pulleys, reverse bends, snub or take-up pulleys. No breaker is required . . . and Ray-Man *holds* fasteners. Also has exclusive XDC Cover for longer life.

- **HIGH COVER-ADHESION ALL AROUND**—top, bottom, and edges
- **FULL COVER THICKNESS USED**—no breaker needed—longer cover life
- **SPLICES LAST LONGER**—hold fasteners better
- **MORE TROUGHABLE AND TRAINABLE**—highly flexible, double compensated
- **IDEAL FOR 45° IDLERS**—guaranteed against separation at idler hinge line
- **OPERATES ON SMALLER PULLEYS**
- **IMPACT CUSHIONED**—resists ripping

ASK YOUR R/M DISTRIBUTOR ABOUT THE ADVANTAGES OF RAY-MAN FOR YOUR INSTALLATION.

Write for Bulletin M302.

R/M Poly-V® Drive Delivers More Power in Less Space ...With More Reliability

A single, endless V-ribbed belt across full width of sheaves with mating grooves. Gives more power per inch of width and advantages never possible with conventional multiple belt drives.

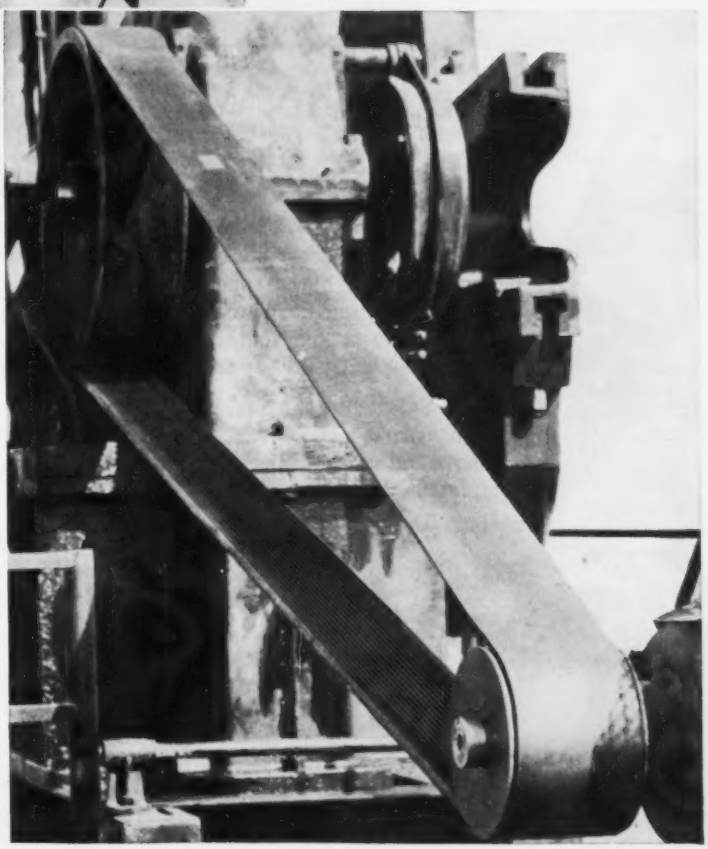
- **SIMPLICITY**—*two* belt cross sections meet *every* heavy duty requirement
- **RELIABILITY**—less maintenance, less take-ups . . . longer belt and sheave life
- **NO MATCHING**—single unit belt eliminates "length matching"
- **BETTER PERFORMANCE**—maintains groove shape, constant pitch and speed ratios . . . runs smoother, cooler

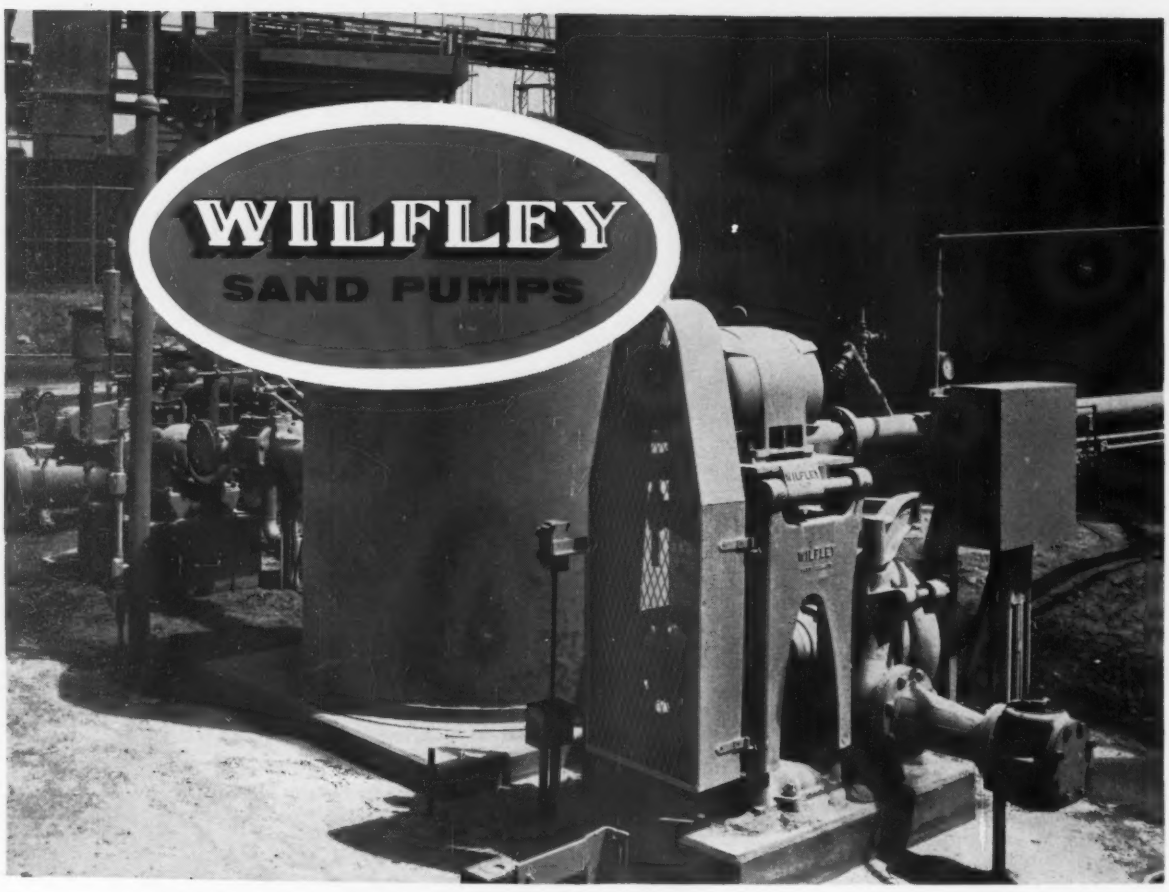
WHEN YOU CHANGE DRIVES CONVERT TO POLY-V* . . . AND BE SURE.

Write for Bulletin M141.

*patented

RM131





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ENGINEERING AND MINING JOURNAL

MARCH 1961

For Educators and Industry —This Is the Year!

FOR MANY YEARS the Council of Education of the AIME has held meetings at annual conventions to thrash out the mutual problems that confront industry and education, and to probe for mutually beneficial constructive programs. To say that such meetings were fruitless would be less than fair. To be sure, they were marked by a three-way crossfire of criticism by engineers, mining educators and representatives of industry management—each segment pointing definitely to certain deficiencies of the other when self examination might have proved more profitable. At the same time many excellent suggestions were advanced to bring modern curricula more in line with the needs of industry; and on the other side of the coin, views discussed showing how industry might use its engineers more effectively, and how engineer-management relations could be improved to attract and hold more talented personnel in the mining industry.

Here, for example, are a few of the ideas proposed at the 1960 meeting of the Council of Education in New York: (1) Prof. H. R. Rice, of the University of Toronto, proposed that mining companies consider a portable pension plan which would assist engineers in accumulating an equitable retirement income. Because of the basically transient nature of the mining profession, this idea has been endorsed unofficially by an overwhelming majority of engineers. (2) S. D. Michaelson, chief engineer, Western Mining Div., of Kennecott Copper Corp., showed how the infusion of principles of industrial engineering and an awareness of management problems in mining school curricula could help engineers serve mining companies more effectively and enhance their chances of rising to positions of higher responsibility. (3) Charles Brinckerhoff, president of The Anaconda Co. suggested that a four-year course consisting of three semesters each year might enable engineers to acquire intensified training in fundamentals with opportunity to expand into the areas of applied engineering sciences.

These are but a few of the excellent ideas proposed for exploration. But, unfortunately, over the years too many of such proposals, and too many of the arguments aired at the meetings were consigned to a cloud of inaction, to be pulled forth for rediscussion and rehash at subsequent meetings. At the conclusion of the 1960 AIME educational session, one of the panel members representing industry asked "Now, what are we going to do about all this discussion?"

Fortunately, it can be reported that during the past year educators and industry have cooperated to establish certain facts, and to explore certain definite areas of opinion that will enable the Council of Education to launch a real program of action during 1961. Evan Just, director of the Department of Mineral Engineering, Stanford University, has canvassed educator opinion; and the writer has sent questionnaires to many mining men in the engineering-supervisory-management bracket of industry for a clarified expression of what industry expects of engineers, and for constructive suggestions to improve mining curricula. Results of these two surveys were presented to the AIME in St. Louis in late February.

However, at this writing, mid-February, it can be reported that industry leaders do have a surprisingly unified opinion on certain basic questions raised at previous educational meetings. Here are a few:

1. By an overwhelming majority, industry engages young engineers not just for their technical proficiencies alone, but to become supervisors and ultimately top executives.

2. Industry has indicated what it expects of engineers by checking 32 functions to be performed by mining engineers and 27 by mineral extraction engineers. Although no single engineer is expected to perform all of these functions at any one time, his training should be broad enough to enable him to handle any one if called upon.

3. The old concept that a young engineer must start out at the muck stick to get the real feel of the job is disappearing. However, many suggest that engineers would do well to round out their practical training by getting summer employment in the mines.

4. There appears to be nothing vitally wrong with current curricula which include mining, metallurgy, geology, mathematics, basic engineering sciences and the humanities, except that industry would like educators to accentuate certain humanities to develop the art of oral and written communication, and the ability to understand and get along with people. And, industry would like to see more emphasis on courses which will give an engineer cost-consciousness, a business sense, and an introduction to the fundamentals of scientific management (usually called industrial engineering.)

5. It is recognized that this is going to take additional training. Most members of industry believe that a five-year course should be considered.

6. Industry is undergoing an evolution in attitude toward the young engineer. A substantial number of companies (not a majority) is willing to take the engineer in as a partner to management—with positive training programs, company-financed post-graduate education, seminars and staff meetings. This trend appears to be on the increase.

Although the foregoing are but a few of the points covered by the industry questionnaire, they do indicate that industry is willing to cooperate with educators in coordinating basic engineering education with subsequent on-the-job supervisory and management training so that a greater number of qualified engineers may look forward to earning positions of responsibility in the mining industry—"right up to company president" as one respondent put it.

In studying all the questionnaires, we were struck by the personal and thoughtful response from leaders of the industry. Obviously, the subject concerns them deeply. And, it is equally clear that mining educators are eager to expand their contribution to mining progress.

There is a new climate—a climate for action.

TOWN OF HAYDEN has a new look. Kennecott's concentrator expansion program has produced track hopper (1), secondary-and-tertiary crushing plant (2), fine-ore-bin building (3), new grinding & leaching building (4), and new LPF building and water-reclamation thickener, behind old mill building (5). Smelter and sponge-iron plant (top) were completed in 1958.

Ray Div.'s 50% Milling-Capacity Boost

JOHN B. HUTTL

NOW THAT the Ray Mines Division of Kennecott Copper Corp. has completed its $40-million expansion program at Hayden, Ariz., its plants operate on a larger scale, more efficiently, and more safely than ever before. By installing modern facilities for ore storage, transportation, crushing, grinding and flotation, and a new water-recovery system, Kennecott raised its milling capacity from 15,000 tpd to 22,500, a boost of 50%.

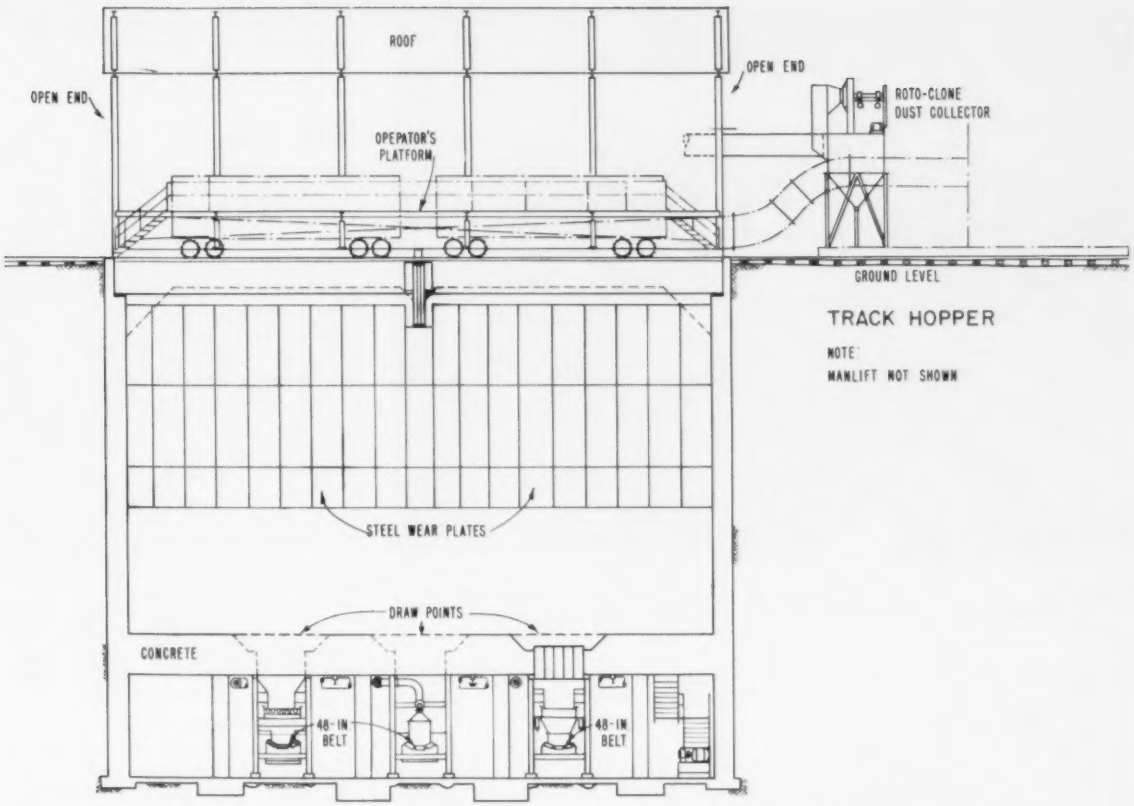
The four-year program, which should extend the life of the division for many years, will help it meet possible competition in the future from other copper producers, both U.S. and worldwide, who are favored with higher-grade ores.

The expansion involved four phases. The last one, now complete, was the concentrator expansion. Construction on this lasted from 1958 to 1960. The three earlier phases were (1) the modern smelter to smelt the division's own concentrates, (2) the LPF plant (leaching-precipitation-flotation) to recover the nonsulphide minerals in the current ore from the Ray pit, and (3) the sponge iron and sulphuric acid plants to make the principal reagents for LPF. Built between 1954 and 1958, these units were reported in detail by E&MJ in June 1959.

Ray's expansion program is part of an over-all expansion-integration program that Kennecott has carried on to try to improve its competitive position Other units of the over-all program that have made news recently are purchase of the Garfield smelter in Utah, building of the new electrolytic refinery near Baltimore, and improvements at other Kennecott divisions in the Southwest. The total cost is estimated at $107.5-million.

To satisfy the increased appetite of the Hayden mill, the company expanded and improved the pit at Ray, some 22 miles away. First, houses and plant buildings near the advancing pit limits had to be moved to more distant sites. Then, the old Ray golf course disappeared as modern, well-equipped repair and maintenance shops, covering 83,320 sq ft under roof, were built on its site. A new 7500-ton steel bin was built astride of twin tracks, to store and load the 10-in. product of the primary ore crusher. Equipped with air-operated gates, the bin receives crusher product via belt conveyor. The old 65-ton cars used for hauling ore from Ray to Hayden were replaced with new 100-ton cars; and in the pit, 50-ton trucks were put into service hauling ore and waste, substituting for the 34-ton trucks used before. The new town of Kearny, built about 10 miles northwest of Hayden, is connected by a short branch road with the Ray-Hayden highway, which is now completely paved.

To expand the old concentrator's capacity by half, the following new units were built: a track hopper, located near the new Hayden-Ray highway and downhill from the concentrator; a crushing plant, for secondary and tertiary crushing; a fine-ore stor-



INTO the track hopper are dumped 100-ton ore cars carrying 10-in. material from pit and primary crusher at Ray, 22 miles away. Twin tracks pass through hopper building. Operator controls train's movement through signal lights, and dumps each car by lever-arm as it passes. Hopper space itself is 48 ft deep. Construction involved 70-ft excavation below ground level.

Pays Dividends in Efficiency & Safety

age bin; a two-section grinding and flotation mill; a new LPF flotation building; and a water-reclamation system that can return 3000 gpm to the mill circuit. You can see all of these units in the aerial view on the opposite page. A new lime-burning plant, built near the smelter, and a new lime-slaking plant are now operating.

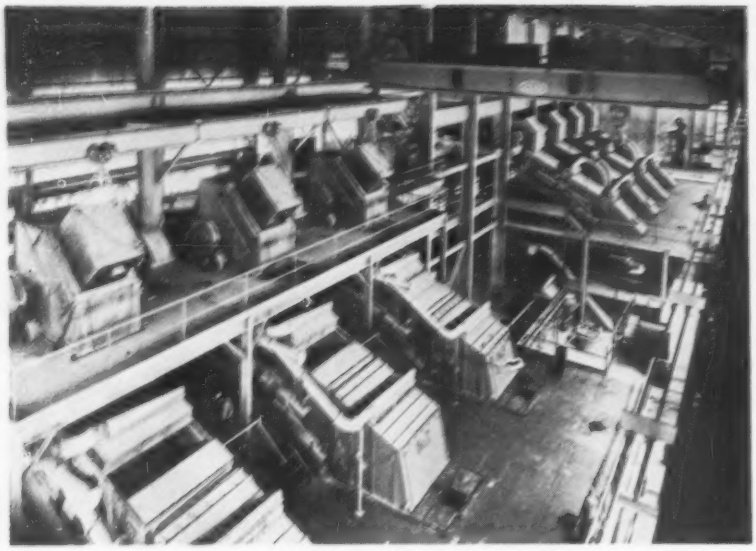
Kennecott's Western Mining Divisions' engineering department had to plan comprehensively to fit the new structures compactly in with the pre-existing mill and plant. Its engineers also studied the most modern practices and equipment for storing, crushing and grinding ore and for materials handling. The modernized Hayden plant is the result of their efforts. Stearns-Roger Manufacturing Co. built and detailed the concentrator expansion.

Metallurgical goal set for the enlarged mill is to produce, from mill heads assaying 0.88% copper: (1) a concentrate averaging 16% Cu by conventional sulphide flotation, and (2) one containing 27% Cu in the leaching-precipitation-flotation plant.

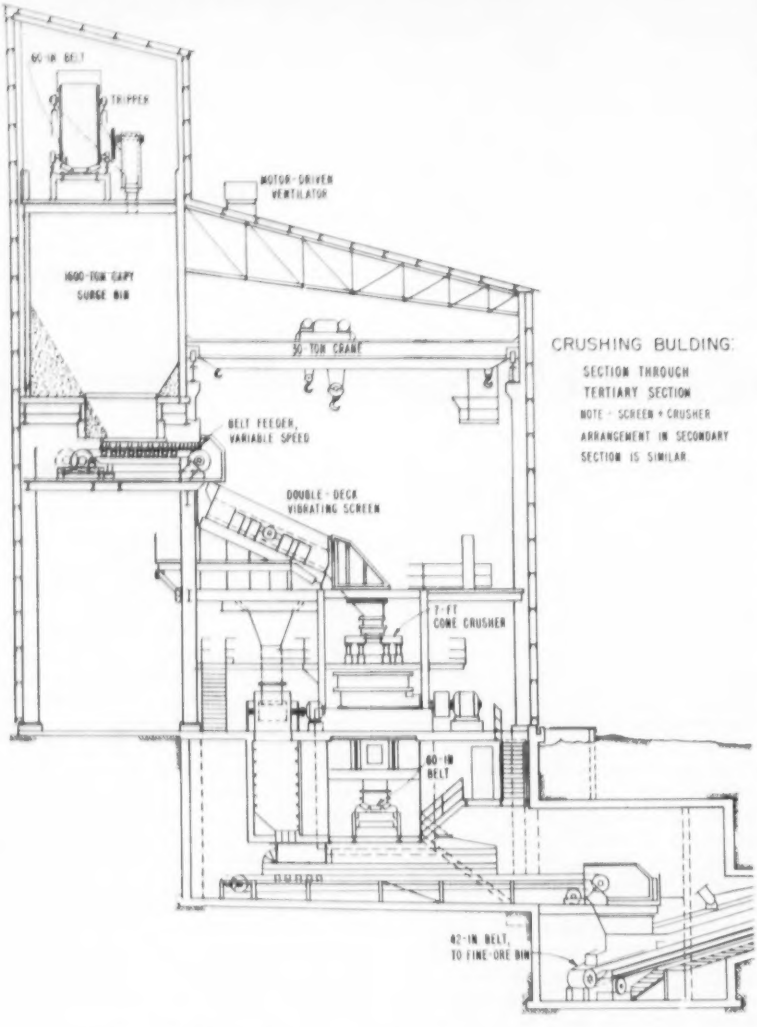
All plant buildings are steel frame structures resting on concrete foundations, with aluminum sheathing and translucent panels for lighting. To see some innovations that assure safety and efficiency, study the plant design drawings on these pages. Notice that the layout of equipment provides flexibility, and makes for easy handling, both during installation and later during maintenance. Stairways and platforms are at points convenient for operators to move about, and they're adequate for local or minor repairs. In the track hopper there is an automatic elevator, which lets the operator reach the feeder and pump floor quickly during inspection periods. Heavy and auxiliary cranes simplify installation and maintenance of equipment. The belt trippers that operate in the crushing plant and in the fine-ore-bin structure are self-reversing on a time-cycle; but there is provision to automate them later, or when appropriate sensing devices are available. Wherever such devices are available now, automatic operation and control of equipment is practiced.

Plenty of room is provided in each building for wiring, piping, launders, belts and conduits. All conveyor belts are interlocked; and all have belt plows, belt rip protection, zero switches, leveling units and other protective devices. There are vulcanizing stations at strategic points in each belt system. Near places where dust is generated, adequate seals are installed, as are dust-control units, chiefly of the Roto-Clone type. The dust that is recovered is sent to the mill circuit as a slurry. Electrical equipment — switchgear, substations, etc. — operates in air-conditioned, dust-free control centers. In two particular ways the designers went all-out to provide for workers' comfort: good building ventilation, so important during the hot summer months; and plenty of lighting, for good visibility after sundown.

Here are the important points about each of the major units in the plant expansion:



IN CRUSHER bldg. (left), operator's control panel (right center, near man) is located with full view of secondary and tertiary crushing sections.



TERTIARY crushing section, shown here, operates in closed circuit with surge bin. Secondary section operates open-circuit on 10-in. material from track hopper.

Track Hopper

This structure (see drawing at top of previous page), which is capable of holding 6000 tons of ore, is situated about 300 ft from, and below, the crusher building. Built of concrete, it measures 60 ft wide, 76 ft long, and 48 ft deep; and at the top it accommodates two standard-gage railroad tracks. Excavating the rectangular pit to a depth of over 70 ft was a major mining operation. The bin proper is lined with steel plate, commencing at 15 ft from the bottom and extending up the sides. At the bottom of the bin are six draw points, each equipped with a hydraulically operated reciprocating feeder; these feeders are equipped with finger grizzlies for loading their respective belts.

Three 48-in. belt conveyors, each served by two feeders, transfer ore from the hopper to the crushing plant above. Each belt is rated at a capacity of 500 tph.

Below the feeder floor are two sump pumps to handle possible water accumulations. A manlift and a service entrance alongside the track hopper give access to the feeders for inspection and maintenance. Auxiliary to the track hopper are a Roto-Clone collector, to control the dust generated as cars are dumped, and a vulcanizing station.

Car dumping is controlled from a central point in the track hopper, and the train's movement through the hopper building is regulated by signal lights, with the operator, by means of a one-lever arm, dumping each car as it slowly passes. Cycle time for each car is 10 seconds. To unload a 38-car train takes from 25 minutes, to a maximum of 45 if fine ore causes hang-ups.

Crushing Plant

There are two crushing sections in the plant, secondary and tertiary. Main equipment of the secondary section is three double-deck vibrating screens and three 7-ft standard cone crushers.

Each 6x12-ft screen receives feed, at 500 tph, from one of the three 48-in. belt conveyors from the track hopper. To the crusher, which is set at ¾ in., goes oversize from the upper screen deck. Lower-deck oversize joins crusher product and goes to the tertiary section. Undersize from the lower deck goes directly to the belt conveyor system feeding the fine-ore bin, which is described later. Screen openings are 1½-in squares, upper

deck, and ½-in. slots, in lower deck.

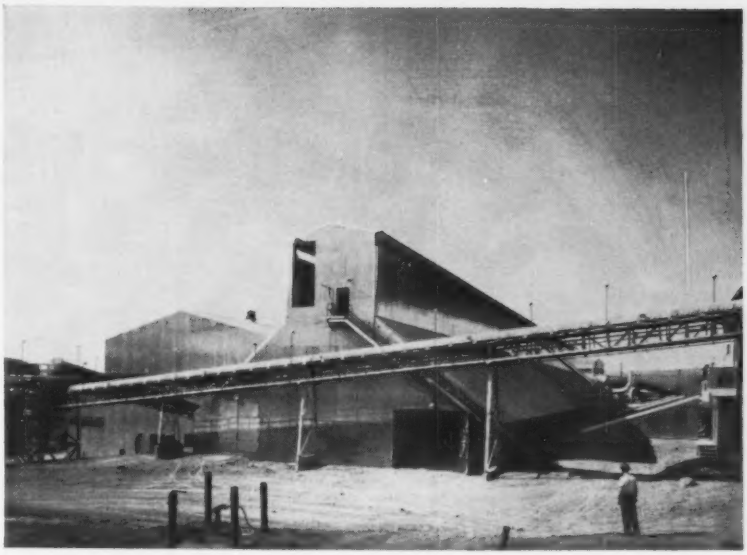
Crusher product and lower-deck oversize drop to a 60-in. belt system, which carries them to a 1600-ton surge bin above the tertiary section. The 60-in. belt system incorporates a transfer house, external to the crusher building, and visible in the photograph on p 84. Above the 1600-ton bin is a self-reversing tripper, operating on the 60-in. belt.

The tertiary section comprises four double-deck vibrating screens and four 7-ft short-head cone crushers. These are fed from the 1600-ton surge bin by four variable-speed belt feeders.

The crushers receive oversize from both decks of the 6x16-ft screens, and discharge to the belt system feeding back to the surge bin. The tertiary crushers are thus in a closed-circuit system. Only the lower-deck undersize leaves the system, going on to the fine-ore bin, to be described.

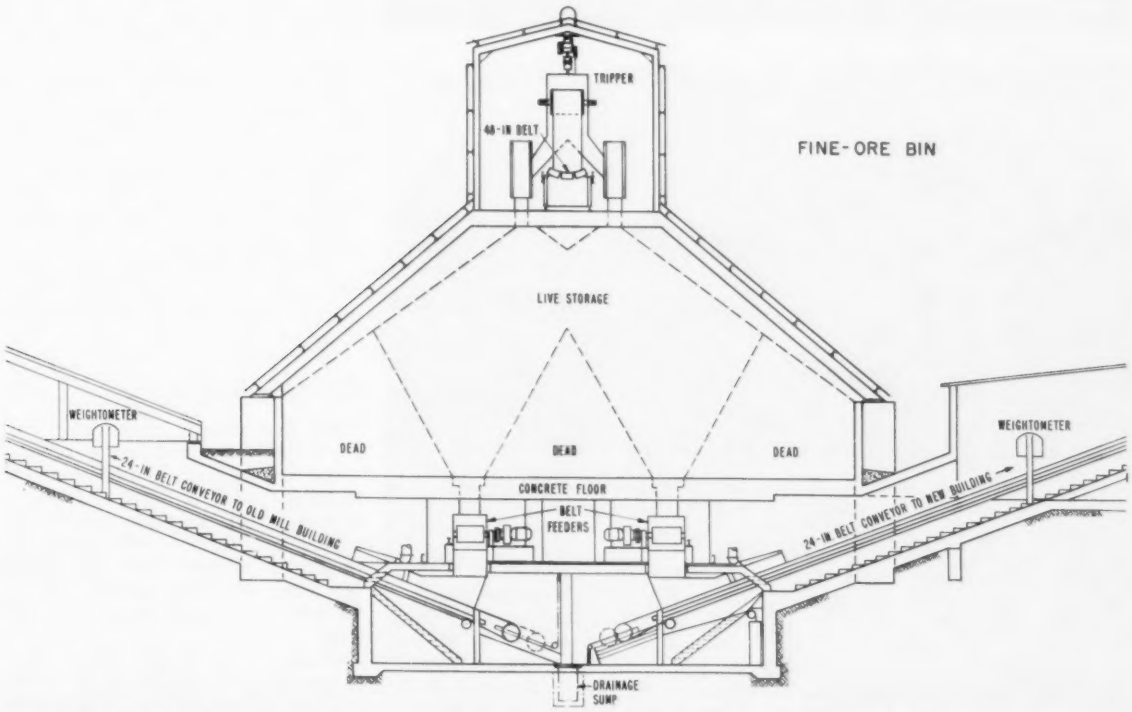
Screen openings are 1-in. squares, upper deck, and ½-in. slots, lower deck. Crushers are set at ⅜-in.

Material that has passed through the lower-deck screens in both the secondary and tertiary sections is combined, and makes the long trek uphill to the fine-ore bin via a 42-in. belt, 2200 ft long. Notice this conspicuous belt in the views on pp 84 and 89. Rising 200 ft, and following the ground where possible, the belt has a capacity rating of 1600 tph. Semicircular galvanized shapes cover it; they are fastened to the conveyor table and hinged for easy access to belt and idlers.

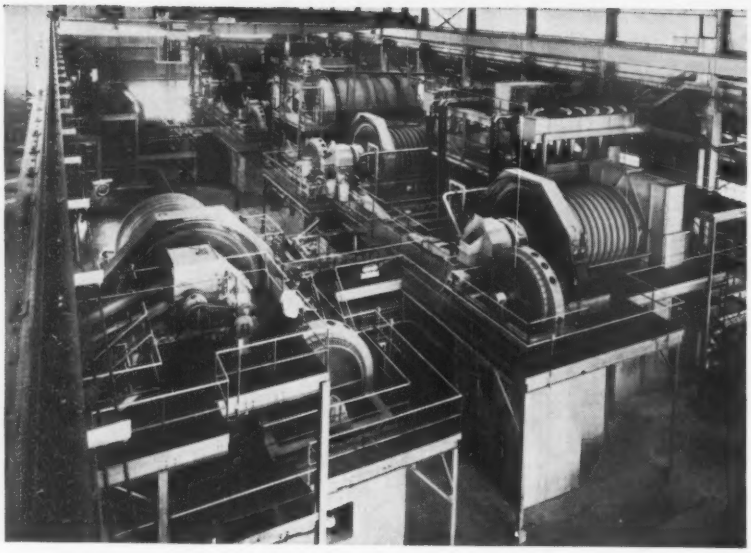


FINE-ORE-BIN structure is essentially a covered stockpile area. Conveyor system carries ore to no. 1 grinding section in old concentrator building (to right).

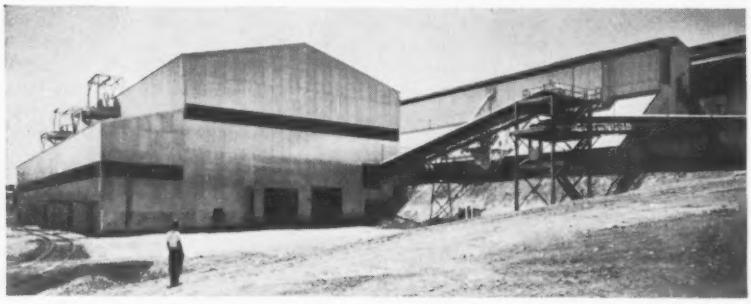
The operator controls plant operations from a central panel board. Pushbuttons with indicating lights show the flow of ore from the track hopper, below, to the fine-ore storage bin, up the hill. Weightometers report rates of flow to the panel. Through an inter-com system, several points between the track hopper and the fine-ore bin can talk with one another. Several of the transfer points in the belt circuits are protected against choke-up, and sensing devices, wired to conveyor emergency-stop switches, save considerable wiring and light in-



MEASURING 380 ft long by 75 wide, fine-ore bin has total storage capacity of 27,900 tons, of which 15,100 is dead storage. Six 24-in. belts, each served by two opposite-traveling belt feeders and a weightometer, send ore to the six mill sections.



MAJOR equipment in new grinding building is clearly visible due to open construction: rod mill, left; ball mills, right and center; leach drum, top center.



WASHING CLASSIFIERS, part of LPF circuit, are housed in alcove at left of new grinding building. Siding is aluminum; translucent plastic panels admit light.

TO RECLAIM 3000 gpm water from tailings, 325-ft thickener was built. New building behind it houses precipitation and flotation sections of LPF process.

dicators on the panel board. Other indicators show crusher oil pressure and other equipment information.

For oil circulation, there is a common header to each crusher oil tank. Two spare tanks help oil-changing as follows: dirty oil from a crusher is drained into one spare tank, clean oil is added from the other spare, then the drained oil is reclaimed. All circulating-oil tanks are water-cooled.

A 30-ton overhead electric crane, with a 5-ton auxiliary hook, services the interior of the crushing plant. In areas where this crane can't reach, I-beams with small hoists do the job.

Dust-collecting systems, made up of Roto-Clone units, serve both the crushing plant and the transfer house adjacent to it. These collect from 0.5 to 1.5% of the tonnage passing through the plant in the form of dust. This is pulped, and pumped as a slurry to the grinding circuits in the concentrator.

Fine-Ore Bin

This is essentially a covered stockpile area. A combination concrete and steel-frame structure with a feeder floor below, it provides storage for a calculated 27,900 tons of crushed ore —12,800 tons in live storage and 15,100 in dead. With the mill rated at 22,500 tpd capacity, the bin can thus hold almost 1¼ days' supply all-told (live and dead storage combined). Several ideas have been evaluated for reclaiming the dead storage, but to date the most practical way seems to be with a track-mounted dozer or a front-end loader. The bin building is 380 ft long and 75 ft wide.

The tripper operating above the bin is self-reversing after running the entire length of the bin. Kennecott plans to automate the operation as soon as suitable sensing devices are available. The discharge slots on both sides of the tripper are covered with rubber belting, for safety and to keep the dust down. As the tripper moves along, the belts are picked up, pass over the tripper, then are laid back down again in their positions over the slots.

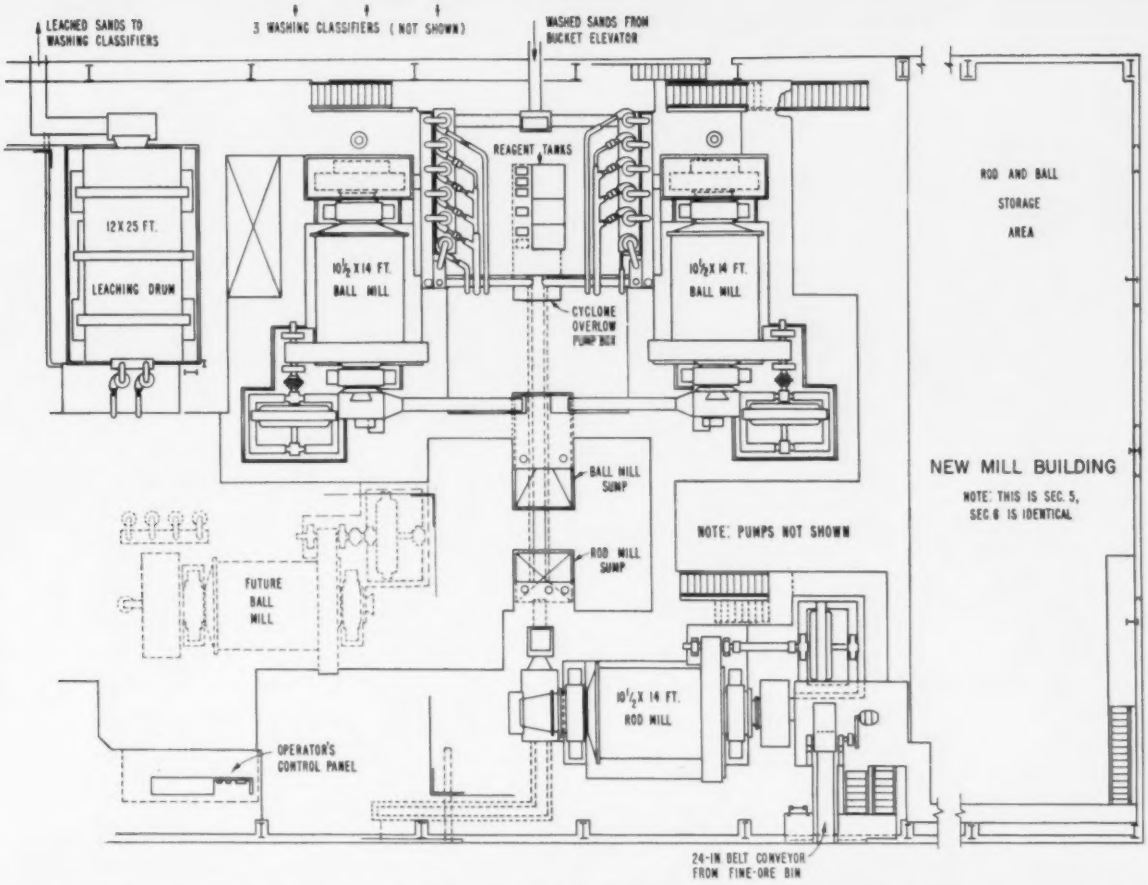
From the bin, ore is transferred to the four grinding sections in the old concentrator building and the two in the new mill building through 12 draw-points in the bin bottom, each of which discharges to a Stearns-Roger type variable-speed belt feeder. These feeders, in pairs, discharge to six 24-in. belt conveyors, fitted with weightometers, which lead to the six respective grinding sections.

A dust collector serves the tripper area; and on the feeder floor, sump pumps handle any accumulations of water.

Grinding Building

The new building houses nos. 5 and 6 grinding and sand-leaching sections. (Secs. 1-4 are in the old concentrator building.) Each of sections 5 and 6 is operated independently. So are the subsequent flotation operations for these two sections; with the result that either or both of the sections can be used for making large-scale mill tests.

Operations in the new mill are controlled from a central panel board, just as in the crusher. Where lime and sulphuric acid are needed at certain points in the circuit, they are


LEACHED SANDS TO WASHING CLASSIFIERS
3 WASHING CLASSIFIERS (NOT SHOWN)
WASHED SANDS FROM BUCKET ELEVATOR
REAGENT TANKS
ROD AND BALL STORAGE AREA
12X25 FT. LEACHING DRUM
10½X14 FT. BALL MILL
10½X14 FT. BALL MILL
CYCLONE OVERFLOW PUMP BOX
NEW MILL BUILDING
NOTE: THIS IS SEC. 5, SEC. 6 IS IDENTICAL
BALL MILL SUMP
NOTE: PUMPS NOT SHOWN
ROD MILL SUMP
FUTURE BALL MILL
10½X 14 FT. ROD MILL
OPERATOR'S CONTROL PANEL
24-IN BELT CONVEYOR FROM FINE-ORE BIN

NEW grinding section 5, above, is identical to section 6. Grinding is two-stage, rod mill and two parallel ball mills. Since each new section delivers to its own independent flotation section, either can be used for large-scale mill tests.

added to it by automatic controllers.

Each new grinding-leaching section has the following as its major equipment: a 10½x14-ft rod mill, in open circuit; a 12x25-ft leaching drum; three rake-type washing classifiers; a bucket elevator; and two 10½x14-ft ball mills, each operating in closed circuit with a bank of four cyclones.

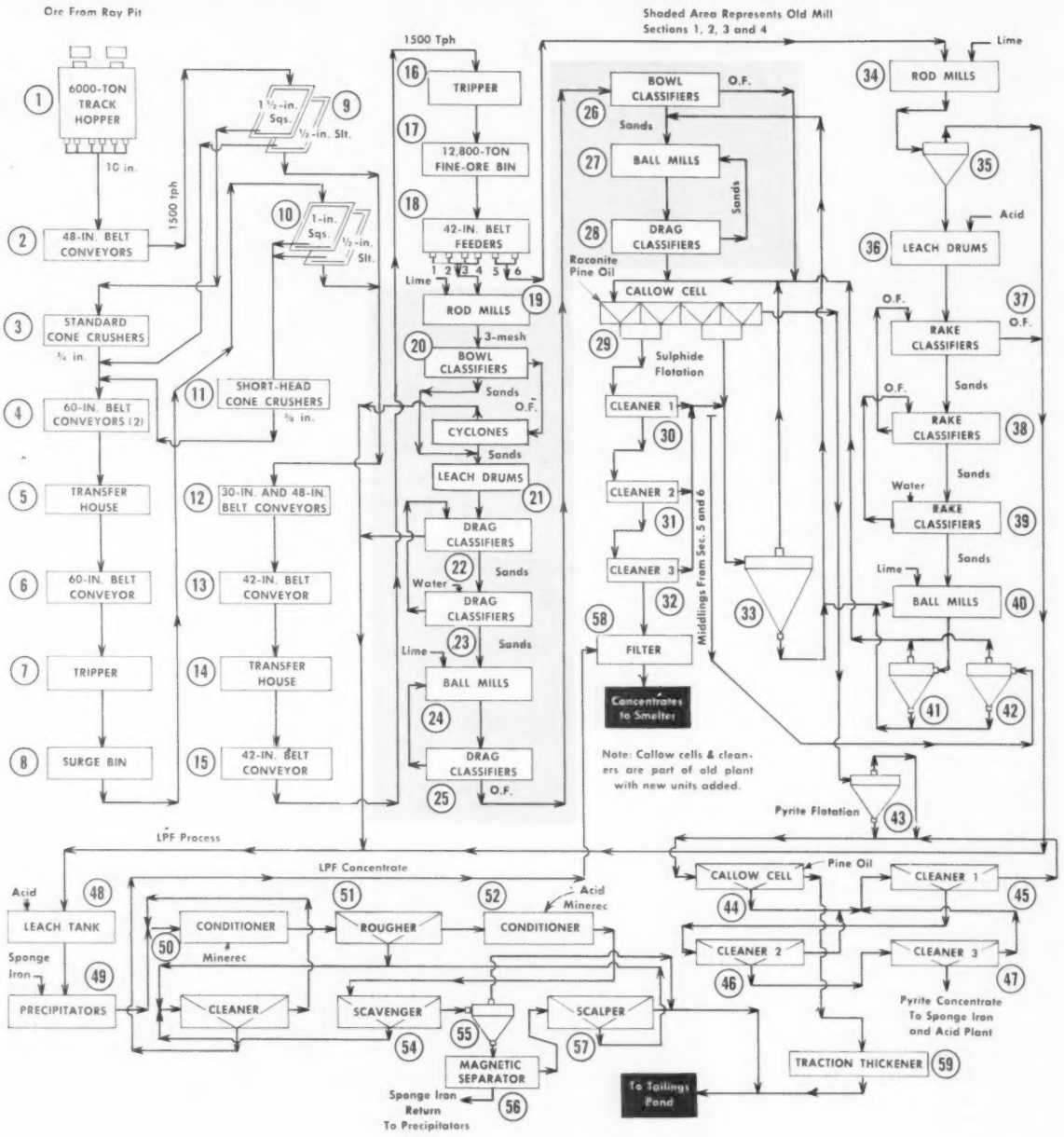
Two cyclones separate each rod-mill discharge (minus 3 mesh) into a minus 3 mesh sand fraction and also a 3%-plus-100-mesh, 8%-plus-200-mesh slime fraction. The sand fraction (cyclone underflow) is then leached in the 12x25-ft leaching drums; the slime fraction (the overflow) is pumped to the LPF processing unit in another building.

Nominal retention time in the leaching drums is 10 minutes. The pH of solution in the drums is kept at 1.5-1.7; about 8 lb of acid are needed for each ton of ore treated.

Leached sands discharging from each drum are washed in three rake classifiers in series, in a countercurrent washing operation, intermediate classifier overflows being sent back to the preceding classifier. The final

WHAT might be called the Ray Div.'s "artery" is the 42-in. belt: all division production must pass over it. Rising 200 ft, it carries up to 1600 tph from crusher to ore-bin.

General Flowsheet of Enlarged Hayden Reduction Works



LEGEND

1. 6000-ton track hopper with 6 reciprocating plate feeders
2. Three 48-in. belt conveyors; each can handle 500 tph
3. Three 7-ft standard Symons cone crushers, set ¾ in.
4. 60-in. belt conveyor
5. Transfer house
6. 60-in. belt conveyor
7. Movable tripper
8. Four 200-ton ore bins
9. Three 6x12-ft double-deck vibrating screens
10. Four 6x16-ft double-deck vibrating screens
11. Four 7-ft short-head Symons cone crushers
12. 30- and 48-in. belt conveyors
13. 42-in. belt conveyor
14. Transfer house
15. 42-in. belt conveyor
16. Movable tripper
17. 12,800-ton fine-ore bin (live storage capacity)
18. Twelve 42-in. variable-speed belt feeders, two for each mill section
19. Four 9x12-ft rod mills, one each at head of mill sections 1, 2, 3, and 4
20. Four 24-ft bowl classifiers
21. Four 12x20-ft leach drums
22. Four 12-ft drag classifiers
23. Four 8-ft drag classifiers
24. Four 10½x14-ft ball mills
25. Four 14-ft drag classifiers
26. Eight 18-ft bowl classifiers
27. Sixteen 7x10-ft ball mills
28. Sixteen 8-ft drag classifiers
29. Sixteen Callow rougher machines
30. Six Fagergren primary cleaners, each made up of three 56-in. cells
31. Six Fagergren secondary cleaners, each made up of four 44-in. cells
32. Six Fagergren tertiary cleaners, each made up of four 44-in. cells
33. Regrind cyclones—six Krebs D-20-B

overflow is pumped to the LPF processing unit. And the final, triple-washed sands are hoisted by the bucket elevator and split between the two ball mills.

From the ball mill—cyclone closed circuit, cyclone overflow is sent as feed to sulphide flotation, which is carried out in the old concentrator building. By adding water to the ball mill, within limits of the ball mill load, the operator controls the pulp density to sulphide flotation. The ball mill-cyclone circuits also receive the underflow of four cyclones that treat middlings from sulphide flotation.

As the volumes pumped to LPF and sulphide flotation vary considerably, all pumps installed at the rod-mill, ball-mill, LPF and sulphide sumps are driven by variable-speed motors, and have sump-level controllers. To reduce spillage and minimize damage to pumps from oversized particles, the company has found it a help to install truncated cones on the rod-mill discharges. These have a slope of 5 in 12, and ⅝-in. holes.

All operating floors in the new building are sloped down to sumps, to make cleanup easier; and the grated decks and platforms allow the operator to observe the equipment at all times. Note the openness, and plain visibility of all equipment, in the photo on p 88.

34. Two 10½x14-ft rod mills, one each at head of mill sections 5 and 6
35. Four Krebs 20-B cyclones
36. Two 12x25-ft leach drums
37. Two 14x35-ft rake classifiers
38. Two 12x35-ft rake classifiers
39. Two 12x35-ft rake classifiers
40. Four 10½x14-ft ball mills
41. Sixteen Krebs 20-B cyclones
42. Four Krebs 20-B cyclones
43. Fifteen Krebs 20-B cyclones
44. Twelve Callow rougher machines
45. Four Fagergren primary cleaners, each made up of four 56-in. cells
46. Four Fagergren secondary cleaners, each made up of four 44-in. cells
47. Four Fagergren tertiary cleaners, each made up of four 44-in. cells
48. 40-ft leaching tank
49. Six Fagergren precipitators, each made up of nine 66-in. cells
50. Six Fagergren conditioners, each made up of four 66-in. cells
51. Six Fagergren roughers, each made up of eleven 66-in. cells
52. Six Fagergren conditioners, each made up of three 66-in. cells
53. Six Fagergren cleaners, each made up of four 66-in. cells
54. Six Fagergren scavengers, each made up of nine 66-in. cells
55. Nine Krebs D-20-B cyclones
56. Three magnetic separators
57. Two Fagergren scalpers, each made up of five 66-in cells
58. Disk filters
59. 325-ft traction thickener

Except for a slightly different equipment setup, the flowsheet of the four grinding and leaching sections in the old mill building is closely similar to that of secs. 5 and 6, described here.

The sulphide flotation circuits at Hayden produce two concentrates: a regular copper concentrate, which is reduced to anode copper in the new smelter; and a pyrite concentrate, from which, by roasting and further processing, sponge iron and sulphuric acid are produced for the LPF process.

The schist—quartz porphyry—diabase ores from the Ray pit contain significant amounts of nonsulphide minerals, which are hard to recover by conventional sulphide flotation. This is especially true of the schist and porphyry portions. In this rock, although the chief copper mineral is chalcocite, about 20% of the copper occurs as copper silicates, as cuprite, malachite, and tenorite, and as native copper. The diabase portion of the ore contains both chalcopyrite and large quantities of pyrite.

Thus the diabase furnishes copper sulphides and the pyrite, for the mill sulphide-flotation circuits; while the other portions (schist, quartz porphyry) give nonsulphides, for LPF treatment, and sulphides for conventional flotation as well.

The LPF process recovers about 2 lb of additional copper per ton of mill feed. When first set up, LPF flotation was done in the old concentrator building; but during the concentrator expansion it was moved to a new building (see below). Into the space that was vacated went six new Callow-type rougher units for sulphide flotation. These six are segregated, three and three; and in conjunction with the two new grinding sections, nos. 5 and 6, they form two parallel test circuits. Two additional cleaner rows complete the parallel circuits.

Pyrite flotation capacity was expanded by 50% by adding four new rougher units and increasing cleaner capacity correspondingly. The general flowsheet covering the expanded Hayden reduction works (opposite) explains in detail both sulphide-flotation and LPF operations.

LPF Building

The building that houses the "PF" (precipitation-flotation) section of LPF lies along the north side of the old concentrator building. You can see its gleaming aluminum sides in lower photo on p 88. As you might guess from the photo, it's designed for gravity flow wherever possible, and its flowsheet includes only a limited number of pumps.

In the building are six parallel rows, of precipitator cells, rougher conditioner and rougher flotation cells, scavenger conditioner and scavenger flotation cells. Sponge iron hoppers and feeders serve the precipitators. On a second-floor level there are six banks of cleaner machines. In the cyclone tower near the lower end of the building, the scavenger tails are put through cyclones, magnetic separators to reclaim sponge iron, and scalper flotation cells.

An overhead electric crane services the LPF building.

Water Reclamation

To return about 3000 gpm of water to the mill circuits, final sulphide tailings are thickened in a 325-ft-dia traction thickener.

Overflow from this thickener is distributed through separate pipe lines in the mill. These lines are interconnected with the raw water system, but the two waters do not mix in the pipe networks. Thickener underflow joins LPF final tails, going to the tailings pond.

Two atomic "Accuray" devices (see p 108), installed on the two 12-in. discharge lines, control the underflow pulp density automatically. A "Y" divides each pipe at the end into two lines. One branch has an Accuray unit, the other a special control valve. When the Accuray detects any change in density, it causes the valve to close or open, thus slowing or speeding the pulp flow to keep the density at a preset figure.

Concentrates Are Pumped

The Hayden mill-and-smelter plant is unusual in the way that final concentrates are handled. Copper concentrates, both from sulphide flotation and from LPF, are pumped from the concentrator to the smelter as a slurry, of about 27% solids by weight. Filter plant is located adjacent to the smelter, rather than being at the mill. Modern materials-handling facilities, mainly conveyor belts, transfer concentrates from filters to storage and ultimately to feed-bins above the reverberatory furnace.

Concentrate slurry is pumped through one of two 6-in. pipe lines, which are laid in a 2700-ft-long tunnel and rise some 80 ft, between mill and smelter. Flow is driven by a pair of sand pumps acting in tandem. One pipe line, and one pair of sand pumps, are kept always on standby.

Pyrite concentrate produced in the mill is pumped to the sponge iron and acid plant in the same fashion, as a slurry of 15-20% solids.

E&MJ staff photographs

NAF McMURDO SOUND is headquarters for all U.S. activities in the Antarctic Continent. To here come all ships and aircraft with personnel and equipment, and from here all work being done at outlying stations is channeled and coordinated.

Antarctica's 'Operation Deep Freeze': A Visit to Geophysical Frontiers

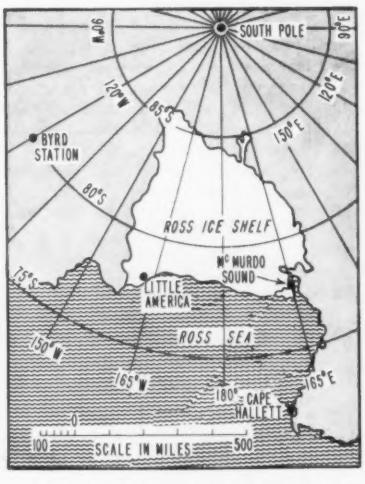
FINN B. DOMAAS

THE ANTARCTICA of Scott, Shackleton, Amundsen and Byrd no longer exists. Where once the adventurer-explorers maneuvered lightweight expeditions to merely set foot on virgin land, Government-supported projects with massive equipment and highly-qualified specialists are now systematically studying every aspect of the Continent. During the current National Science Foundation-U.S. Navy program, "Operation Deep Freeze 61," geology and geophysics are being studied as never before—both from permanent stations and along elaborate traverse routes.

AUTHOR at McMurdo. Volcanic Mt. Erebus continually emits steam.

As part of its commitment to the International Geophysical Year, the United States built and maintained several widely scattered research centers in Western Antarctica. Much valuable data were gathered at the South polar regions during the IGY and if the stations were extremely costly to build and maintain, so would they have appeared that much more expensive if, at the end of the research year, they had been abandoned. Therefore, it was decided that America's south polar scientific activities should be continued—even expanded—and that the work which had been coordinated by IGY committees should be taken over and run by the National Science Foundation through its United States Antarctic Research Program. This agency and the massive land-sea support forces supplied by the U.S. Navy together make up Operation Deep Freeze.

Over the years, and as expeditions to the South became larger and more complex, the amount and quality of research in large measure depended on the ability to get investigators to and from field areas and to make sure that remote stations were at all times well equipped. Dog teams, once basic to all expeditions undertaken during the South's "Golden Age," were soon abandoned and replaced by more effec-



ROSS SHELF, world's largest floating ice mass, is the size of Spain.

Official U.S. Navy Photograph

MEMBERS of the University of Wisconsin-sponsored McMurdo-to-South Pole geophysical traverse used 12-ton Tucker Sno-Cats without crevasse detectors—arrived Feb. 12, ahead of schedule. Party included: (top row, l to r) Mario Giovinetto, glaciologist from Ohio State; Dr. Albert Crary, leader, chief scientist of the National Science Foundation's Antarctic Research Program; Sveneld Evteev, Russian exchange glaciologist; Jack Zahn, glaciologist, Ohio State. Bottom row: Ardo Meyer, geomagnetician, U.S. Coast & Geodetic Survey; Edwin Robinson, geophysicist, University of Washington; Ralph Ash and Jack Long, traverse engineers, University of Wisconsin.

AT BYRD geologist William Long and paleontologist George Doumani (sunglasses) test a speedy motor toboggan.

LOCKHEED C130 Hercules has revolutionized Antarctic research. Here, one prepares for take-off from NAF McMurdo.

ART RITCH supervised test drilling for Martin Co.'s atomic power plant.

MARTIN'S ATOMIC generator was to be at Hut Point, McMurdo Sound. Drilling showed only permafrost and site was moved to Observation Hill behind McMurdo.

DR. ROBERT NICHOLS (right), chairman of the department of geology, Tufts University, has spent several research seasons in the South. This season, he and his party analyzed Antarctic geomorphology in the mysterious, ice-free dry valleys.

tive, specially-designed land, sea and aircraft.

Effective vehicles were oft-times slow to be developed and results were sometimes disastrous, but occasionally an equipment mover was introduced which so neatly fit into the Antarctic situation that it not only outmoded other forms of travel but was able to actually change the conception and scope of broad areas of investigation. Just such a vehicle was introduced last year—Lockheed's C130 Hercules: It's a four-engined, ski-fitted flying cave which can carry tremendous amounts of cargo, and can land almost anywhere. Scientists and military personnel agree that if it had been available 10 years ago, our present Antarctic research would have been advanced by a decade.

Probably the most publicized projects of Deep Freeze 61 were the three University of Wisconsin-sponsored geophysical traverses—two from Byrd Station and the other from Naval Air Facility McMurdo Sound, America's Antarctic headquarters.

The McMurdo-to-Pole traverse was led by Dr. Albert Crary, chief scientist for the United States Antarctic Research Program. The objectives of the traverse, as outlined by him several days before the group left McMurdo on Dec. 8, were: checking ice thickness surface and subsurface elevation; recording annual snow accumulation; surveying mountain ranges encountered along the route; taking magnetic field surveys; and doing some limited geological and biological reconnaissance. The eight-member party would live and work in huge Tucker Sno-Cats from which it would only be necessary to leave when readings and other data had to be gathered.

Crary's party cruised along part of the gigantic Ross Ice Shelf (world's largest mass of floating ice—approximately the size of Spain), chugged up the Skelton Glacier on the Shelf's western shore, and then, while on the central Antarctic highland plateau, as a control for previously-obtained data, criss-crossed the route taken by the Fuchs-Hillary Trans-Antarctic Expedition of 1958. What was of prime interest and of no little importance to the Crary traverse members was that the vehicles carried no crevasse detectors. Dr. Crary explained that the detectors were not nearly accurate enough to justify the reduced vehicle speed and possible need for equipment repair while enroute. Crary's feelings about the detectors seemed to be valid —the National Science Foundation recently reported that, despite initial delays, the McMurdo geophysical team arrived safely at the Pole on Feb. 12 —loaded with information and ahead of schedule. At that moment, Dr. Crary became one of very few individuals who have stood at both the North and South Poles.

At Byrd Station, deep in Marie Byrd Land east of the Ross Ice Shelf, Wisconsin conducted more geophysical investigations, both in the air and on land.

John C. Berhendt, veteran Antarctic researcher who had done geophysical reconnoitering around and on the Filchner Ice Shelf during the IGY, was one of a three-man airlifted traverse party that would take continuous readings of the variation in total magnetic-field intensity between stations and make data-landings in areas difficult to reach by land or not yet covered by over-snow traverses. This season, Berhendt told E&MJ he planned to make eight seismic landings between the Hudson and Koehler Ranges, and get an aeromagnetic profile of the same area.

When seeking details of bedrock buried beneath an ice mass, several distinct problems must be dealt with, and Berhendt was quick to point them out. Seismic shots and readings from the ice surface could perhaps give a misleading conception of what actually lay below. The readings, Berhendt said, are accurate for any specific point, but that point may be topographically unique and not representative of the area over which the readings are obtained. Gravity procedures, however, present an average reading of sub-ice rock pulls, but may not be accurate for any given point. By tackling an area with both seismic and gravity procedures, a more precise presentation of sub-ice conditions is obtained.

Another Antarctic geophysical problem is that, in very cold firn, the large amounts of surface waves (which Berhendt claimed were from extremely low temperatures but the nature of which was as yet not fully understood) create an interference that destroys the value of many surface readings. In warmer zones, and as the season progresses, interferences diminish; at higher elevations, interference remains constant. To overcome the disturbance, field men must drill deeper blast holes and use smaller charges. Two men with hand augers can drill 10 meters an hour—must get down 20 meters for more accurate wave readings.

Berhendt next touched upon two ice-probe schemes that were at that time still experimental. One plan was for the possibility of determining ice thickness by aeromagnetics. Volumes of data were collected during Deep Freeze 60, he said, and work was underway with the hope of being able to accurately analyze them. Another project

SIR ERNEST SHACKLETON'S simple cabin, Cape Royds, McMurdo Sound. Though built for the 1908 expedition, neither hut nor sled have decayed. In contrast, modern Byrd Station is a buried city of ionospheric and meteorological facilities.

—radio wave ice sounding—was also in the primary stages and may produce extremely interesting and rewarding results.

Between Byrd Station and the Pole lie the Horlick Mountains, and to these the Ohio State University team returned to continue work in an area that had, until Deep Freeze 60, been untouched—almost unknown. William Long, Ohio State glaciologist, field worker in the Horlicks during 1958 and '59, and one of two principal investigators during 1960-61, said the formations were a continuation of the mountain chain that extended from Cap Adare along the eastern border of Victoria Land to the Queen Maud Range—were massive, tabular blocks which dipped slightly to the South. Formation outcroppings were extensive and the Permo-Carboniferous uppermost series contained coal beds, shales, sands and conglomerates. Plant and animal organisms had also left traces. To this area, therefore, came George Doumani, Ohio State paleontologist, to collect and correlate fossils in one of the few such localities in all of Antarctica. Doumani hoped to find index fossils which may make it possible to relate Antarctica with other regions of the globe and thereby increase the knowledge of the Continent's age and geological history.

While still at Byrd, their jump-off base, Long and Doumani (and this editor) unpacked and tested a speedy, maneuverable motor toboggan which, if it performed as well in the field as it did at Byrd, could become the standard short-trip survey vehicle—combining the light weight of a dog team with the durability of more heavy, cumbersome machinery. Called the Eliason Motor Toboggan, and made by the Four Wheel Drive Auto Co., Kitchener, Ont., Canada, the unit holds a four-cycle Briggs & Stratton engine which spins a snow-gripping rubber belt that pushes the sleigh along at more than 25 mph. Not only at Byrd, but also at McMurdo, all who had had considerable ice experience and who saw the motor toboggan felt that it held great potential as an Antarctic transporter.

ADELIE PENGUINS return every year to the same hill near Shackleton's camp.

On the western shore of McMurdo Sound, approximately 25 miles north of the main U.S. base, lies an amazing area, free of almost all ice and snow—the dry valleys. Here, at Marble Point, Dr. Robert Nichols and a team of investigators are piecing together the depositional and erosional cycles that eventually produced the shape and nature of the present Antarctic land mass. Dr. Nichols, a veteran south polar scientist, is a geomorphologist and heads Tufts University's department of geology. At the Taylor Dry Valley, he and his assistants examined stratigraphic exposures, fans and cross-bedding to begin speculating what must have gone on at that area and elsewhere before the region chilled. Like any field geologist, Nichols must correlate—must find some reference point around which to refer older or younger deposits, earlier or later processes. Dr. Nichols was asked about any reference points that he might have uncovered. He had indeed come upon a very appropriate clue—on an elevated beach, a mummified seal—which was at that time undergoing carbon 14 analysis.

Not all roving parties in the Antarctic were geophysical. The University of Michigan had a glaciological team roaming the western and southern edges of the Ross Ice Shelf, studying its mass balance, the mechanics of deformation, and the nature of its movement. Dr. Charles Swithinbank has found that most of the ice that feeds into the Shelf, and which keeps it in balance, comes from the east—from the Marie Byrd highlands—and not from the west and southwest. (See map.)

Potentially the loneliest scientist attending Deep Freeze 61 was USBM's John Mulligan. He came to the Antarctic alone, to tag along with any available party and get to areas where he might obtain estimates of mineral deposits. He knew he'd find coalbeds—he'd been there before and done preliminary mapping—but was now also interested in which, if any, other mineral concentrations might be exposed. Though he hadn't yet been able to leave McMurdo by the end of November, he said his report for the present season would be submitted to the Bureau by mid-summer of this year.

FROM THE MINE. Lump ore, blast furnace ore, fines and waste (right to left), are piled below crushing-screening plant.

DOWN THE 7½-MILE CONVEYOR SYSTEM. The 24-in. conveyor system runs at 550 fpm and has an average capacity

Modernization Adds 1-Million TPY

A. T. YU

MINA CARMEN, one of the largest of Compania Minera Santa Fe's wholly-owned high-grade iron ore mines in Northern Chile, has recently been completely mechanized to add over 1-million tpy capacity to Santa Fe's rapidly expanding production.

In addition to the newly acquired mining equipment, a modern crushing-screening plant and a 7½-mile belt conveyor system have also been put into operation. It is believed that, with this up to date mechanization, Mina Carmen has emerged as one of the largest and most highly mechanized mines in Chile. The 7½-mile conveyor system is the longest ever built in South America and is the longest ore-carrying conveyor in the world.

Engineering and fabrication of the mechanization program commenced in October 1959 and site preparation commenced in November. During July 1960 the crushing and screening plant was put in operation and the 7½-mile conveyor system in December. The entire project, representing an investment of $3-million, was completed in a remarkably short period in slightly over one year.

Dr. Yu is director of engineering for the West South American Overseas Corp., New York, N. Y.

Tracdrills Begin Mining

Open pit benches, set up at 5 to 7.5-m levels, are perforated by medium-duty Tracdrills with 1¾-in.-dia rods. Air is supplied by 600-cfm compressors. After the 3-in. dia holes, spaced 7 to 13 ft are drilled, they are loaded with ammonium nitrate, primed with dynamite, and detonated by Primacord. Then the blasted rock is loaded by 2½-yd diesel shovels, with the help of bulldozers, into 27-ton rear-dump heavy pit trucks. Blasted iron ore is trucked from various levels through a distance varying from 1½ to 2 miles to the dumping platform of the crushing plant. Nor-

The Carmen deposit is located about 40 miles east of the seaport of Chanaral, at approximately 26° 20′ latitude south, and 70° 12′ longitude west. The mine is approximately 3000 ft above sea level. The principal deposit is located in volcanic rocks, probably of Jurassic age, belonging to the Andean geosyncline, practically at the contact with an intrusive granite body related with the Andean batholith (Cretaceous). The mineralization cosists of magnetite, more or less replaced by hematite (martitization) with a small portion of quartz, apatite, hornblende (actinolite) and pyrite. The main deposit has a roughly tabular form, with an east-west strike and an average dip of about 35° to the south. The total thickness of the high grade mineralization changes from 65 ft at the upper central part of the deposit to more than 165 ft toward the west end.

of 440 tph with occasional surges of 550 tph. Note the sodium lamp lighting system with 140-watt lamps spaced along the line.

TO THE PORT OF CHANARAL. (Via Hermotita Siding, see map p 96.) Here various ores are blended before shipment.

Iron Ore to Chile's Mina Carmen

mal production at two 8-hour shifts yields an average of 4000 tpd. A monthly 100,000 ton production is obtained by scheduled six-day weeks.

Iron ore is fed by 27-ton rear dump trucks at the dumping platform into the primary hopper. At the bottom of the hopper, a 72-in. manganese pan feeder, driven by a 4-speed motor, regulates the flow to achieve relatively even feed for the crusher. At the head end of the feeder, stationary manganese grizzly bars are installed to let through minus 8-in. material. Plus 8-in. material moves over the grizzly bars into the jaws of an Allis-Chalmers 60 x 48-in. A-1 crusher. The corrugated jaw plates are set at 5½-in. to obtain the desired 8-in. maximum output.

At the bottom of the crusher pit, 36-in. conveyor No. 1 collects, first, the minus 8-in. grizzly undersize, and then, crushed iron ore. Because of the severe service of this conveyor, the grade-A belt requires a top cover with a thickness of ⅜-in. and a nylon breaker strip to absorb excessive shock and wear. (See flowsheet, p 98.)

Conveyor No. 1 brings iron ore at an angle of 15°, through a distance of 100 ft, to the top of the screening station where it is fed to a double-deck vibrating screen. This screen has a top deck square opening of 3 x 3-in. and a bottom deck opening of ½-in. square. Oversized material is fed through chute work onto a 3-in. picking conveyor (No. 2), where rocks and waste are dropped through chutes onto another conveyor (No. 6) and stacked at the waste pile.

Lump ore (plus 3-in. and minus 8-in.) is fed onto a 30-in. stacking conveyor (No. 3) to form a lump ore stockpile of 15,000 tons maximum capacity. Iron ore between 3-in. and ½-in. in size going over the bottom deck is fed through chutework onto a 24-in. stacking conveyor (No. 4) to form a storage pile of 35,000 tons in capacity. Ore fines under ½-in. through the lower deck of the screen are collected by an 18-in. conveyor (No. 5). The storage capacity of the fine-ore storage pile is 40,000 tons.

A 30-in. tunnel reclaiming conveyor (No. 7) runs under both lump ore and minus 3-in. plus ½-in. ore piles. Ore is reclaimed by gravity through manually operated feed gates. A similar 30-in. tunnel reclaiming conveyor (No. 8) is installed under the fine ore pile. Conveyors No. 7 and 8 are equipped with a variable speed drive and each has a maximum capacity of 500 tph. At a common junction the two conveyors pass ore to a belt feeder which in turn feeds the 7½-mile conveyor system. To regulate the rate of flow, the belt feeder is equipped with a weighing scale, which is electronically interlocked with drives on conveyors 7 and 8.

All conveyors in the crushing-screening plant are sequentially interlocked with the belt feeder and the 7½-mile system. All motors are squirrel-cage, 380-v, 50-cycle, 1400-rpm. All the truss work and steel construction is designed to withstand earthquake conditions.

To allow wind clean-up of the ever-present ore dust, no covering is provided for any of the structures. The entire plant is so laid out that the prevailing wind always blows away from the machinery. An additional feature of the layout makes it possible to install future magnetic separation equipment when necessary.

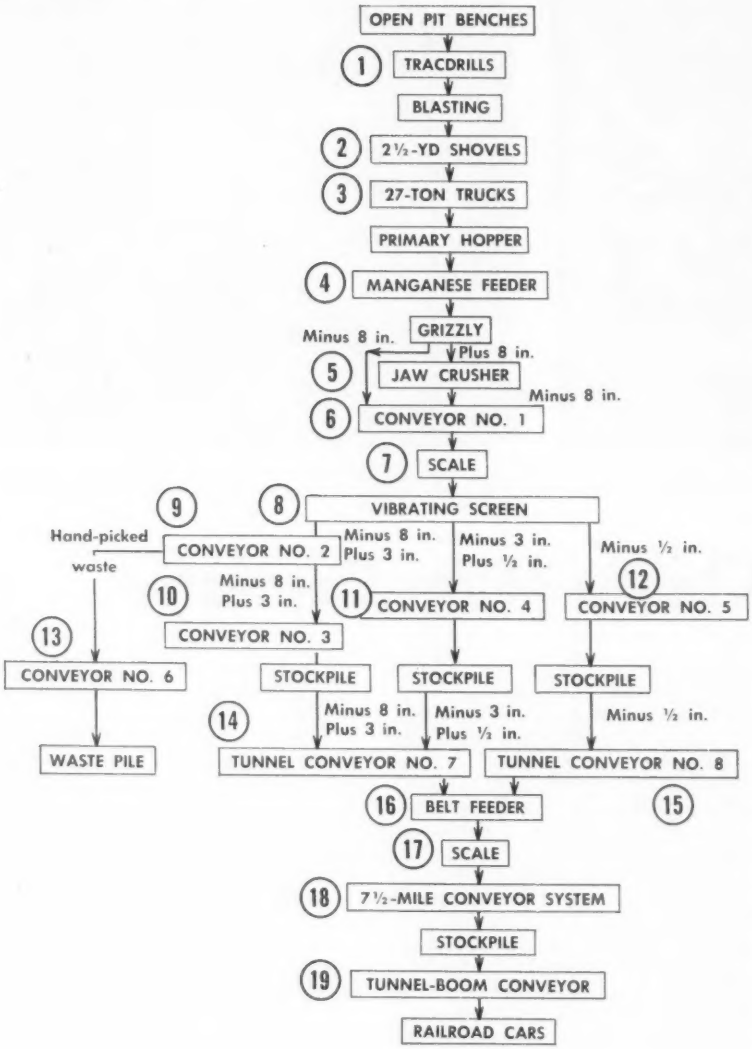
The Carmen crushing plant is located 7 miles north-east of the Hermotita Siding, a rail junction approximately 30 miles east of the mechanized Chanaral loading port. With a number of Santa Fe's small mines nearby, various grades of rich iron ore can be blended at the rail yard into the exact desirable grade for final rail shipment.

Railroad vs Belt Conveyor

Exhaustive preliminary studies were conducted comparing different methods of transportation from Carmen to Hermotita. In the final analysis, choice narrowed down to railroad vs belt conveyor system. While the projected first cost of the conveyor system was higher than that of the railroad, the conveyor system was selected because of its long range lower cost per ton transported, taking into consideration the continued operating, maintenance and amortization costs.

The Crushing Plant is 3000 ft

Flowsheet of Mina Carmen, Compania Minera Santa Fe



LEGEND

1. Joy TDM Tracdrill with 450 Dritter, 1¾-in.-dia rods, 3-in.-dia bits, with tungsten carbide Inserts.
2. P&H 955A, 2½-yd diesel shovels with full manganese bucket.
3. 27-ton rear-dump pit trucks, Euclids and Aveling-Barfords.
4. Taylor-Wharton Tisco Manganese Pan Feeder, 72-in. x 13-ft 9-in., maximum capacity 1000 tph, with 4-speed drive, 30 hp.
5. Allis-Chalmers 60 x 48-in. A-1 Jaw Crusher 250-hp squirrel cage high-torque motor. Force-feed lubrication system.
6, 9, 10, 11, 12, 13, 14, 15. Hewitt-Robins Belt Conveyors—see chart on opposite page.
7. Merrick Scale Weightometer MLSV-859.
8. Hewitt-Robins 60 x 168-in. double deck vibrex screen, capacity 670 tph.
16. Newcon Horizontal 30-in. belt feeder, 40-ft long, speed 375 fpm, maximum capacity 600 tph, with 10-hp squirrel cage motor.
17. Merrick Scale Weightometer.
18. Newcon 7½-mile, 24-in. downhill conveyor system—see separate chart.
19. 30-in. Newcon Tunnel-Boom Conveyor, 166-ft 2-in. long, maximum lift 28-ft 1½-in., 1000 tph.

above sea level and nearly 1000 ft higher than Hermotita siding. To avoid extensive blasting and bridge work, a slightly longer conveyor line skirting the south end of a hillside was selected. In order to simplify spares problem, and to achieve highest over-all economy, the line was broken up into thirteen 24-in. conveyors. The longest of the conveyors is 4020 ft from head to tail pulleys. Maximum grade of descent is 7%.

The lengths of the conveyors were so selected that highest tensions at the worst load conditions did not exceed an optimum economical limit, enabling the use of identical belting throughout the system. Another consideration in the final design was the standardization of the drives. Motor hp varies from 40 to 75 maximum—only three sizes of motors were used for all 13 units (40, 60 and 75).

Some of the conveyors in the system, because of their configuration, become re-generative when loaded. Consequently, running hp required for the entire system is actually less than that which is required to start. Thrustor brakes were installed on all re-generative conveyors to prevent them from "running away" when loaded. Electrical interlock was so designed that maximum protection could be achieved.

The main control panel of the system is at the head end of the last conveyor. Emergency pull cord switches are installed along the conveyors to enable the operators to stop all the feeding conveyors in emergencies. The entire system of conveyors is sequentially interlocked so that each conveyor will start only after its receiving conveyor is running nearly at full speed.

To minimize the transmission losses, line voltage is stepped up to 11,000 v, and stepped down at each drive station to 380 v. Auto-transformer starting is utilized to cushion the starting shocks to the equipment.

The 24-in. conveyor system runs at 550 fpm and has an average capacity of 440 tph with occasional surges of 550 tph. Scheduled to work approximately 10 hours per day the system results in a 1-million tpy rate of transportation.

To reduce the power consumption to a minimum, a sodium lamp lighting system with 140-watt lamps, spaced at 120 ft was installed along the line. A telephone system was also installed so that operators at each junction could communicate with others to achieve effective maintenance. The last conveyor of this system is elevated to form a stock pile of 8000 tons, representing two days' production at the mine. A 30-in. tunnel conveyor reclaims the ore and brings it through a boom to feed the railroad cars. The reclaiming conveyor has a capacity of 1000 tph.

Intermediate sections are standardized in 10-ft lengths. Supporting posts are bolted on railroad ties which are

Conveyor Flight Data

Conveyor Flight No.	Length (c/c Pulleys) (ft)	Rise (+) Fall (−) (ft)	Motor (hp)	Condition	Position of Driving Unit
1	2238	−115	40	Regenerative	Feed end
2	4021	−112	75		Discharge End
3A	2336	0	75		"
3B	2351	+ 14	75		"
4A	2798	− 68	75		"
4B	2800	−160	60	Regenerative	Feed End
4C	2416	−138	40	"	"
5	1667	− 96	40	"	"
6A	3363	−138	75	"	Discharge End
6B	3236	−107	60		"
7A	3571	− 56	75		"
7B	3568	− 36	75		"
8	768	+ 40	40		"

in turn set in the ground. Standardized terminal junctions are erected on reinforced concrete foundations. Wind hoops were installed at 30-ft intervals along the conveyor.

A diesel-electric generating plant was installed at a distance of ¾ mile from the crushing plant. This plant was built to accommodate four 400-kw diesel generating sets. At the start, three generating sets are installed giving a total of 1200 kw capacity, sufficient to operate the entire transportation, mining, crushing and camp facilities. Power was generated at 3300 v, 3 phase at 50 cycles to be stepped up to 11,000 v for transmission. To avoid hazards of blasting in the mine, transmission lines were routed on the far side of the mine hill, increasing the transmission distance to about 1 mile from the power plant to the crusher plant.

Engines are vertical, eight cylinder, four starter, turbo-charged, each developing 660 bhp at 750 rpm. Due to a water shortage, radiators were used.

The alternators are of the protected type, revolving field, salient pole, having an output of 400 kw, 500 kva at 0.8 power factor each, directly coupled to the engines.

Major mining equipment was from the U.S., Great Britain, Japan and France; major construction equipment was from the U.S. Cement and reinforcing steel were shipped from Germany. The crushing and screening plant was furnished by Hewitt-Robins in the U.S., and the 7½-mile conveyor system was furnished by New Conveyor Co., Birmingham, England. The power plant and majority of the electrical componets were furnished by Lancashire Dynamo & Crypto Ltd., Manchester, England. Construction Contractor was Monberg & Thorsen, Copenhagen, Denmark.

West South American Overseas Corp. had the over-all responsibility of planning, design, coordination and purchasing for the entire project.

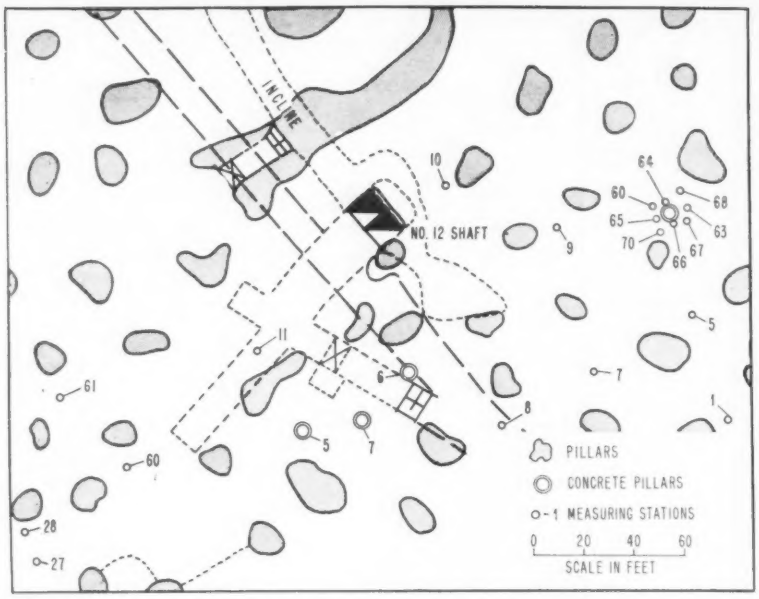
Crushing & Screening Plant Major Equipment Schedule

Conveyor	Width (in.)	Length (ft)	Lift (ft)	Speed (fpm)	Capacity (tph)	hp	Remarks
1	36	120	28	200	670	30	minus 8-in. ore
2	36	35	0	65	400	3	picking belt minus 8-in. plus 3-in.
3	30	160	35	200	310	20	stacking; minus 8-in. plus 3in.
4	24	160	40	200	250	20	stacking; minus 3-in. plus ½-in.
5	18	167	43	200	85	7.5	stacking; minus ½-in.
6	18	290	0	200	20	3	waste
7	30	304	10	220	560	25	reclaiming; minus 8-in. plus 3-in. or minus 3-in. plus ½-in.
8	30	104	8	220	560	15	tunnel reclaiming; minus ½-in.

Hewitt-Robins vibrating screen	60 x 168-in. (27°, ⅜-in. stroke, 800-rpm, 15-hp)
Allis-Chalmers jaw crusher	60 x 48-in. (250-hp)
Manganese pan feeder	72-in. x 14-ft (30-hp, 4-speed motor)

IRON ORE is fed by 27-ton rear dump trucks at the dumping platform into the primary hopper. Uncovered system allows wind cleanup of the ever present dust.

SCREENING STATION receives crusher product and sorts to four products. All conveyors are sequentially interlocked with belt feeder and 7½-mile system.

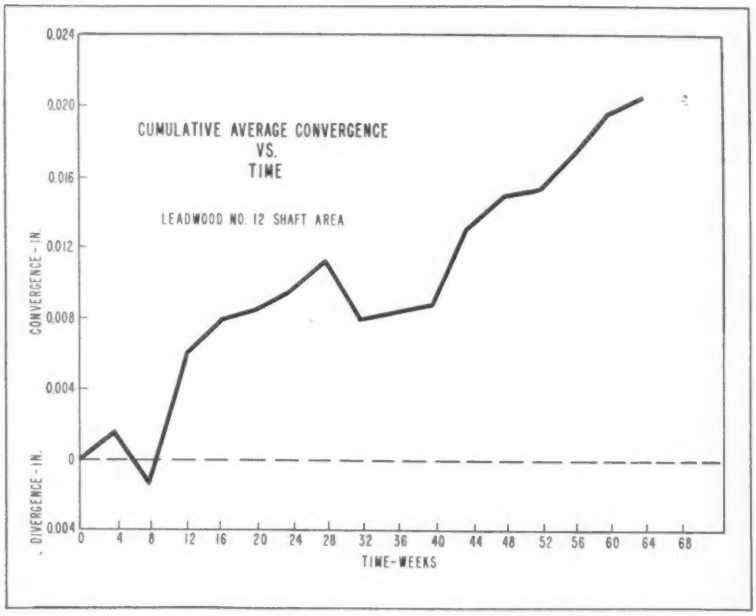


OPEN for many years, the Leadwood No. 12 shaft area began showing indications of progressive instability, according to convergence measurements (see graph).

St. Joe Builds Practical Rock Mechanics Tools

JOHN J. REED

C. DAVID MANN



BECAUSE of the increased trend towards instability, old pillars were wrapped with wire rope, additional concrete pillars built, and fill added to critical areas.

THE MINE RESEARCH DEPARTMENT of St. Joseph Lead Co. has built a number of relatively cheap and reasonably accurate devices during the past five years to measure stope and development opening convergence—measurements that can indicate possible rock failure.

By making its own measuring instruments, suited to a variety of conditions, St. Joe can determine safe or unsafe areas, areas that should be abandoned, or areas that require additional support.

A further refinement of some instruments is the addition of a light that illuminates when the convergence reaches a critical point. Thus, the miner is provided with a visible warning of ground movement.

The company now has, at minimum expense, a wealth of data that indicates stability or instability of any given area. One example of the results of such data collecting is illustrated at the left. Other examples will be given following a detailed description of the devices.

It is hoped that this article and others like it will stimulate mining operators to make more use of the valuable tool of rock mechanics instrumentation. Such equipment need not be complicated nor difficult to understand or operate. It is designed specifically to augment, but not to replace, the intuition of the experienced miner and the judicious use of the sounding bar.

It has been amply demonstrated that in many cases of impending roof failure, precise measurements will detect the trend long before any visible or audible signs of failure are evident. It will be of real service to the industry if others who have made use of this method will publish descriptions of their work.

The design philosophy, which made possible the relatively cheap and practical accumulation of data, is important: Because of the extreme heterogeneity of the rocks individually, and of the mine structure as a whole, it is apparent that more confidence can be placed in numerous measurements of reasonable accuracy, than in a few of extreme accuracy. Furthermore, duplication of results leads to confidence in the over-all picture; for example, a trend towards stability or instability of a given area.

With few exceptions, the instruments for making rock mechanics measurements are not commercially available "off the shelf." However, many are relatively straightforward to build if one has ingenuity and a

Dr. Reed, formerly head mine research engineer for St. Joseph Lead Co., is now professor of mining engineering at Colorado School of Mines. Mr. Mann is mine research engineer with St. Joseph Lead Co.

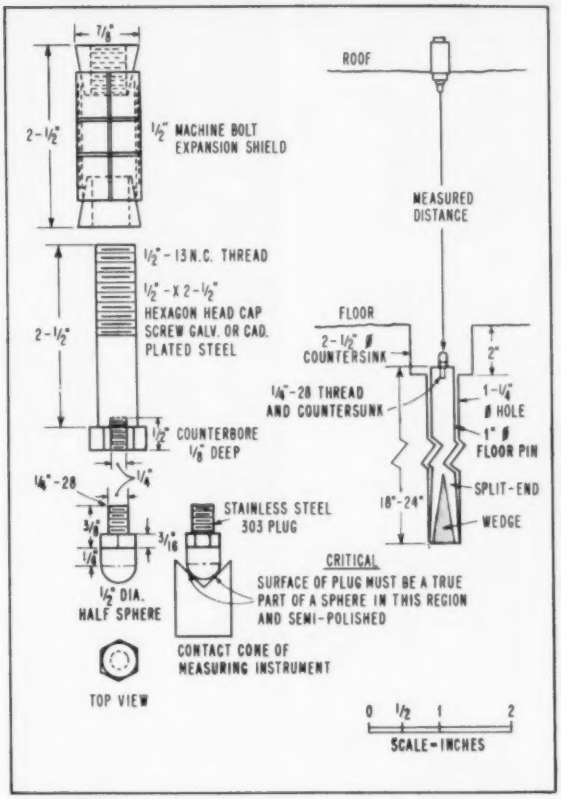


FIG. 4a Measuring station components (see also the photographs on this page) and installation are detailed at the left.

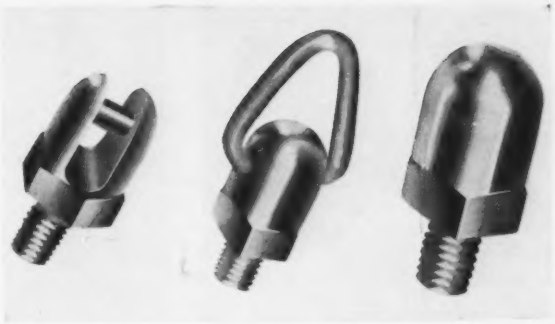


FIG. 1 Stainless steel measuring station plugs, modified for application, are basic components of many stations.

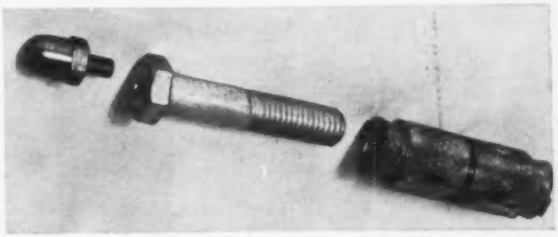


FIG. 2 Cap screw and expansion shield provide anchorage for station plugs when installing points in the roof or wall.

FIG. 3 Components of a roof and floor station comprise 1-in.-dia mild steel rod (center) split to take a wedge on bottom and bored on top for plug. The components enable anchorage at least 2 ft below the floor or above the roof.

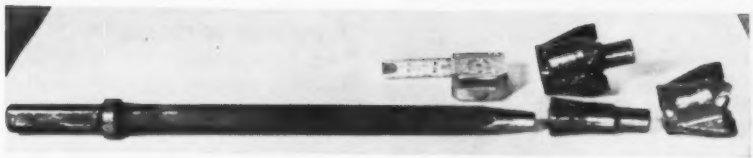


FIG. 4b The reaming bit and its 1⅛-in.-dia pilot adapter are held on the drill steel by a 7° taper. A hole is drilled for the wedge and rod (above) and the upper 2-in. reamed.

good machinist available at the mine.

The instruments developed were designed to use standard components of minimum cost wherever possible. The small stainless steel plug shown in Fig. 1 and 2 is a prime example. This plug, and the special cap screw shown with it in Fig. 2, are used in many variable applications as the key components of permanent measuring stations.

The fundamental criterion used in the design of all the instruments was to make one precise instrument which could be placed on any set of permanent station points to make a precise reading, but which could be used on any number of such stations between times, and be stored safely.

The stations themselves were designed to be as inexpensive as possible, easy to install, permanent and reasonably protected from damage by mining machinery, blasting, etc. Of course, they must not obstruct mining operations.

Basic Components Are Cheap

The details of the basic station components are shown in Fig. 4a and they can be described as follows:

Stainless Steel Plug

The plug is the basic component of the permanent measuring stations for several instruments to be described. It is made of Type 303 stainless steel, ½-in. hex in cross-section. One end has ¼-in x 28 NF threads, and the other end a ½-in.-dia hemispherical head to fit the conical socket of the extensometer. As shown in Fig. 1, this same plug can be fitted with a stainless steel bail or with a slot and stainless steel pin.

The plug is available from the St. Louis Screw and Bolt Co., 6900 North Broadway, St. Louis, Mo., at a cost of about 55¢ each in lots of 100, or 28¢ each in lots of 500.

Two modifications of the plug are used with the horizontal and vertical tape extensometers. In the first case, a ⅛-in. hole is drilled through the plug ¼ in. from the round end, and a 2-in. piece of ⅛-in. stainless steel

FIG. 5 Special concrete insert casts measuring stations in permanent position.

welding rod used to form a rigid bail as shown in Fig. 1. The bail enters the transverse hole in the plug ¼-in. from each end.

In the second modification, also shown in Fig. 1, a 3/16-in. slot is milled through the hemispherical end of the plug to a depth of ½ in. Then a ⅛-in. hole is drilled 3/16 in. from the end of the plug and at right angles to the slot. A ½-in. length of ⅛-in. ss welding rod, forced through this hole and peened on both ends, forms another type of rigid bail attachments.

Special Cap Screw

When installing points in the roof or wall, the ss plug is usually anchored by means of the special cap screw and standard double expansion shield shown in Fig. 2. A standard steel cap screw, ½-in. x 2½-in., is drilled and tapped through its head to take the ¼-in. x 28 NF threads of the plug, and then it is cadmium plated. The ¼-in. threads are counterbored ⅛ in. to assure a firm seat for the plug. This special cap screw is available from the same source as the plug at a cost of about 37¢ each in lots of 100, or 25¢ each in lots of 500.

Expansion Shield

This is a standard ½-in. machine bolt expansion shield which fits into a ⅞-in. drilled hole. The shield is available from any hardware supply house at about 35¢ each.

Floor Pin

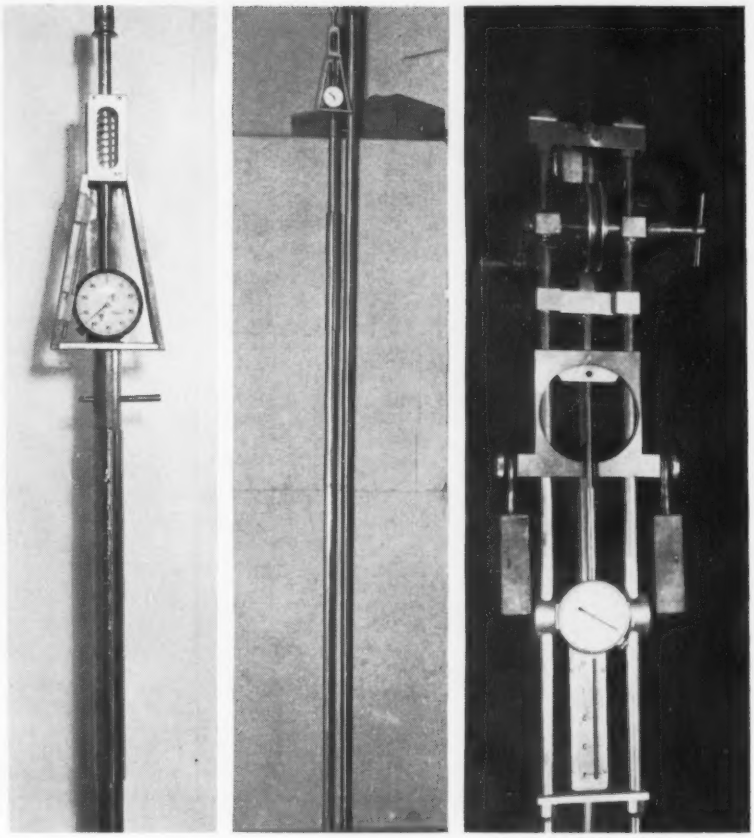
It has been found through experience that a station anchored in the immediate floor will often be in a loose slab, which will lead to disturbance by heavy traffic such as loading machines, shuttle cars, trucks, etc. Therefore, it is necessary to obtain actual anchorage at least 2 ft below the immedate floor by means of a floor pin (Fig. 3).

This pin, made in the mine shop, is of mild steel rod, 1-in. dia by 24-in. long. The bottom end is split to take a ⅞ x ⅞ x 4-in. wedge, while the top is drilled, tapped, and counterbored for the ss plug. This pin is set in a 1¼-in. hole drilled 18 in. deep. A protective countersink is provided at the top of the hole by reaming with a 2½-in. bit to a depth of 2 in. This places the ss plug an inch or two below floor level, where it is protected by a wad of waste.

The reaming bit and its 1⅛-in.-dia pilot adapter are held on the drill steel by a 7° taper (Fig. 4b). This bit is available from the Craig Bit Co. of North Bay, Ontario, Canada, at a cost of about $20 each.

Concrete Insert

A special concrete insert (Fig. 5) is used where stations can be cast into the linings of shafts and tunnels, or in concrete pillars. It consists of a standard ½-in. concrete insert to which is welded a heavy washer plus a short section of 2-in. pipe. The insert is bolted to the forms before pouring, and when the bolt and forms are later removed, the special cap screw plus ss plug are installed within the protection of the countersink formed by the 2-in. pipe.



FIGS. 6, 7, & 8 Left to right—tube extensometer, tube extensometer hanging vertically in its calibration bar, and vertical tape extensometer. The tube extensometer, which reads to 0.001 in., consists of two or three telescoping tubes plus a dial gage. It is calibrated with stainless steel bar shown in the center. Vertical tape extensometer, although less accurate than tube extensometer, has a greater height range.

General Note of Caution

All components of permanent measuring stations must be installed as tightly as possible, and all threads should be doped with some compound similar to liquid solder, etc., which will cause them to freeze and never loosen by vibration, etc. This is a very important detail because any looseness and movement within the station is likely to go undetected for some time; and when and if finally detected and corrected, this will then render all previous readings erroneous and useless.

Tube Extensometer Makes Precise Measurements

The tube extensometer is used to make precise deformation measurements between pairs of permanent stations anchored in the roof and floor of mines, tunnels and other massive structures. Basically, it con-

sists of two or three telescoping tubes of Type 304 stainless steel plus a dial gage which measures directly to 0.001 in.

A special feature of this extensometer is its precise coarse adjustment to the nearest inch by means of a taper pin connection between the telescoping tubes. This connection will remain a precise adjustment regardless of wear in the tapered pin or holes.

As shown in Fig. 6, there are 12 holes at 1-in. intervals near the top of the outer tube, while the inner tube has matching holes at 1-ft intervals. The tapered pin used for the coarse adjustment can be seen end-on in hole No. 1. The second tapered pin, which shows clearly in a transverse position, gives a precise connection between the measuring head and the top of the inner tube. Thus, the entire head of the instrument is easily removable for storage and transportation.

With the two basic tubes, the instrument is adjustable from 7 ft 10 in. to 12 ft 7 in., and a third tube extends this range to about 18 ft. However, at maximum height the instrument becomes difficult to handle, and especially to read, because the dial gage is always at the top. With a modification now being built, it is planned to keep the dial gage always at eye level, and use lighter extension tubes to reach high stations.

As shown in Fig. 6, the delicate feeler of the dial gage operates entirely within a protective auxiliary plunger which it follows, and which is heavily spring-loaded to hold the entire extensometer firmly in position on the floor and roof stations. The tubing used in this instrument is all 1 1/16-in. thick, and the outside diameter varies from 1 in. to 1¼ in. The contacts at top and bottom of the extensometer are conical sockets to fit the hemispherical station plugs.

An essential auxiliary to the extensometer, and indeed to any precise measuring instrument, is a permanent standard bar to which it can be compared. The standard bar for the tube extensometer is shown in Fig. 7. It is made of the same grade of stainless steel as the instrument, and therefore if the two are allowed to stabilize, they will expand and contract together, and give a constant check-reading through a wide range of temperatures. The instrument can thus be calibrated, and temperature corrections obtained for routine use in the mines.

The ideal material for all these instruments would be invar steel, but its availability in standard shapes and small quantities is extremely limited.

FIG. 9 Horizontal tape extensometer, starting end above, is basically a chrome-plated mine surveying tape.

FIG. 10 The tape is led over an aluminum pulley, snapped into bail of second station, and led back to the first station.

The coefficients of linear expansion of some common metals are as follows:

Invar steel (36% nickel)	1.4×10^{-6}
Stainless steel, Type 304	10.4×10^{-6}
Steel	6.1×10^{-6}
Brass	10.0×10^{-6}
Aluminum	13.0×10^{-6}

The advantage of invar is apparent.

Vertical Tape Extensometer Has Good Height Range

This instrument, with an indicated accuracy of ± 0.003 in., is inherently less accurate than the tube extensometer. Its principal advantages are its greater height range and the fact that it always reads at eye-level. It is difficult to hook into the roof station at heights over 25 ft without special equipment. Jointed aluminum poles can be used up to 25 ft.

The instrument, shown in Fig. 8, is used to make precise deformation measurements between pairs of permanent stations anchored in a vertical line in the roofs and floors of mines and tunnels. The sensing element is a 4-in.-range dial gage which reads to 0.001 in.

Enough steel tape to read any desired height is carried on a built-in reel. The upper tape is hooked in a roof station, using the special ss plug with bail, Fig. 1. The tape is drilled with small index holds at intervals of 0.3 ft, and through these holes it is pinned to the main frame of the instrument at the appropriate point just above eye-level from the floor. The entire constant weight of the instrument tensions the upper tape.

The lower tape is of a fixed length which will place the instrument at eye-level. This tape is hooked into a floor station, using the ss plug with the milled slot and pin. The lower tape passes through a guide slot and over a pulley on the main instrument frame, and is then permanently pinned to a small central frame which slides freely up and down on the main frame.

The sliding frame is counterweighted with lead blocks. Thus the lower tape is also under a constant tension, and there are no springs involved which must be calibrated, etc. The dial gage registers the relative motion between the sliding frame and the main frame, and this is equal to the total convergence.

Horizontal Tape Extensometer Reads to 0.005 In.

This instrument makes measurements between permanent stations in the walls of drifts, tunnels, or shafts. Although it was designed primarily to measure horizontally, the same principle can be used to measure at any angle, including the vertical. Excessive ventilating-air velocities will affect the accuracy of any tape extensometer because of tape "flutter".

The instrument, shown in Fig. 9 and 10, is basically a chrome-plated mine surveying tape on a standard reel. A harness snap is riveted to the free end of the tape, and at 3 ft from the end, also riveted, is a 6 x ½-in. machinist's scale graduated to 0.01 in.

On the back, or smooth, side of

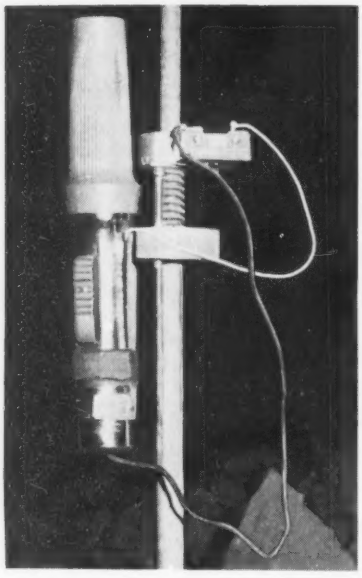


FIG. 11 Stope convergence warning lights are well received by the miners.

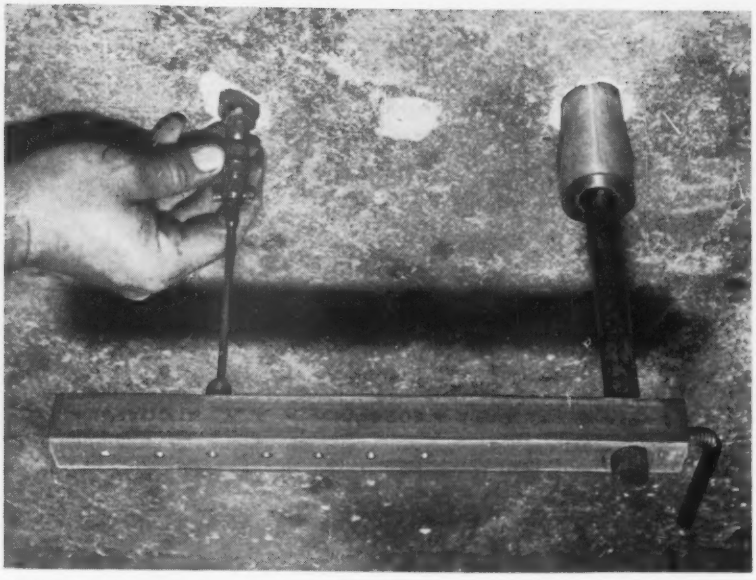


FIG. 12 Detection device for roof dilation consists of untensioned roof bolt free at outer end, a 1-in.-square aluminum bar and station plugs in bar and roof.

the tape, lines are scribed across the width of the tape at precisely 6-in. intervals. Each scribe mark is numbered consecutively from the free end of the tape with a carbide-tipped marking pen.

Each station is equipped with the bail-type ss stud previously described, and in addition, the starting station has a special thin ss strap bracket held by the cap screw. This bracket is bent at right angles, and the end which protrudes from the station has two ¼-in. holes: one for an aluminum pulley, and the second for a safety chain.

To take a reading, the free end of the tape is snapped into the bail of the starting station (Fig. 9), led over an aluminum pulley snapped into the bail of the second station (Fig. 10) and returned to the starting station (Fig. 9). There the tape goes over the pulley snapped to the ss bracket and hangs freely 1 to 2 ft below the pulley.

A constant tension is applied to all the tape by a 5-lb block of lead fastened to the reel, and the safety chain prevents the reel from falling down the shaft, etc., if the tape should break. The two passes of the tape are held close together by guides at the machinist's scale, and one of the scribe marks is read against the scale markings. Comparision with subsequent readings indicates the deformation.

Because the pulley system doubles the ground movement, the readings are divided by two, so the over-all instrument accuracy is to the nearest 0.005 in.

Lights Give Warning of Ground Movement

Stope convergence warning lights are very useful in a working area. They give immediate warning of any ground movement during noisy operations when it would not otherwise be detected. The device, shown in Fig. 11, is very simple and inexpensive; and is usually well received by the practical miner. It consists of telescoping tubes of thin-wall electrical conduit which are spring-loaded between the roof and floor.

The tubes support a micro-switch and a flashlight having a red signaling wand extension. The tubes are adjustable in various stope heights, and the micro-switch can be adjusted so that a convergence of only a few thousandths of an inch is enough to turn on the light.

By noting the turns of the adjusting screw required to trip the switch, an experienced operator can determine approximately how much convergence has occurred between shifts, etc., if ground movement is quite rapid. Several of these warning lights placed around a stope during noisy operations, such as drilling and loading, contribute appreciably to the safety and morale of the workers.

Device Detects and Measures Roof Dilation

This device is used to detect and measure separation or dilation within the roof rocks. The installation consists of a roof bolt anchored at any desired depth in the roof, but free at the outer end as shown in Fig. 12, and untensioned.

An aluminum bar 1 in. square and 12 in. long is clamped to the free end of the bolt and fitted with a standard ss station plug. This plug is fixed in any one of the several tapped holes in the bar so as to be directly below a second standard plug anchored in the immediate roof, as shown.

An ordinary machinist's inside micrometer is used to measure the gap between the plugs to 0.001 in. Any opening or dilation of the roof rocks between the point of bolt anchorage and the immediate roof surface will appear as a decrease in the measured gap.

A threaded 5/16-in. rod in the end of the aluminum bar provides the means to position the bar and clamp it to the bolt. A tapered aluminum plug, 1⅛ x 1⅝ x 4-in., with a clearance hole for the bolt, is driven into the mouth of the borehole to keep the bolt centered.

The point of anchorage of the system can be placed at more than one bolt-length depth in the roof, if desired, by using couplings between bolts. However, each coupling should include a set-screw into each bolt to eliminate accidental loosening, and also to permit salvage of the entire assembly later.

This type of installation has been used in connection with the removal of a single very large pillar in a stope about 180 ft high. In such a height, neither the tube nor the tape extensometer could be used to measure

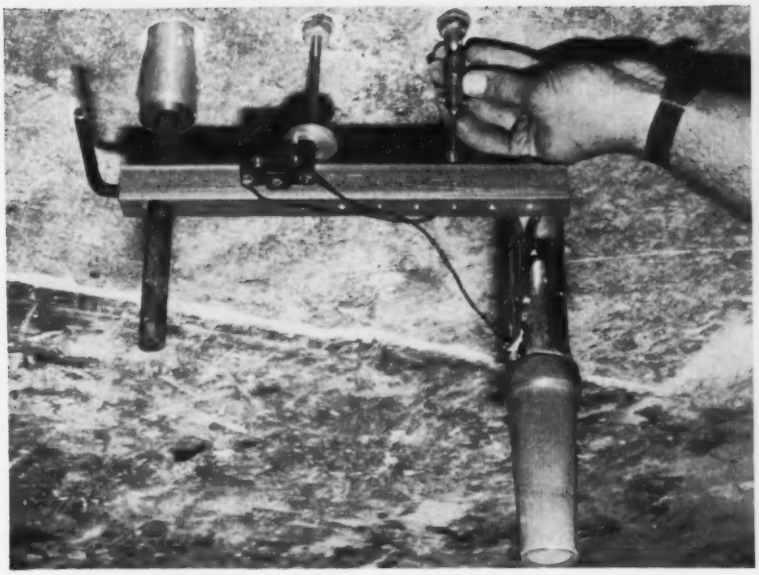


FIG. 13 A warning light can be added to the dilation detector by fastening a flashlight and micro-switch to the bar and by anchoring a second point in roof.

FIG. 14 Whittemore strain gage is reliable in concrete pillars and linings.

from the floor to the roof, but the roof was accessible from catwalks suspended from it, extended from a point of access on the stope wall.

Fig. 13 shows a modification of the dilation detector with a warning light added. The flashlight and microswitch are fastened to the aluminum bar, and a second point is anchored in the immediate roof in line with the roof bolt and the first point. A threaded rod screwed into the head of the anchored cap screw provides an adjustable contact for the microswitch.

Whittemore Strain Gage Is Used In Concrete Pillars

The standard Whittemore mechanical strain gage, used regularly by civil and mechanical engineers, has a gage length of either 2 or 10 in. The gage used by St. Joseph Lead was especially made by Baldwin-Lima-Hamilton, and has a length of 20 in. so as to straddle more of the inconsistencies of the rock being measured for strain. A similar instrument, with adjustable gage lengths, is supplied by Soiltest Inc., 4711 West North Ave., Chicago, Ill.

In use, stainless steel reference points are anchored in countersunk holes as shown in Fig. 14, and the Whittemore gage, with extra-long (4-in.) probes, measures the relative motion between the points to the nearest 0.005 in.

The dependability and value of such measurement may be limited when measuring the strain in a rough rock surface, becuse the reference points are anchored in a surface layer of rock, which may be loose and at least partially strain-relieved. When used in concrete pillars and linings, the Whittemore results are much more consistent and dependable.

Seismitron Requires Skilled Operator

This device consists of a very sensitive borehole type of geophone connected to a powerful amplifier. The theory of the equipment, and the detection of microseismic noises in connection with predicting rock failure, were developed by the USBM's Applied Physics Branch under the direction of Dr. Leonard Obert.[1]

Most miners are familiar with the pops and cracks produced by the "working" of heavy ground. There is also a preliminary period during which sub-audible noises are emitted at an increasing rate as the rock approaches its point of failure. The Seismitron, now marketed by Walter Nold, 24 Birch Road, Natick, Mass., permits these sub-audible noises to be heard and recorded at so many counts per minute.

It should be emphasized that this instrument and technique are far more subjective than objective. It is useless to apply the system on a hit-and-miss or spot-check basis. However, if a single individual can stay with the instrument and become familiar with its characteristics in a given mine and rock type, he will learn to interpret what he hears to advantage. Otherwise, the situation is analogous to a layman trying to diagnose respiratory or heart conditions the first time he picks up a stethoscope!

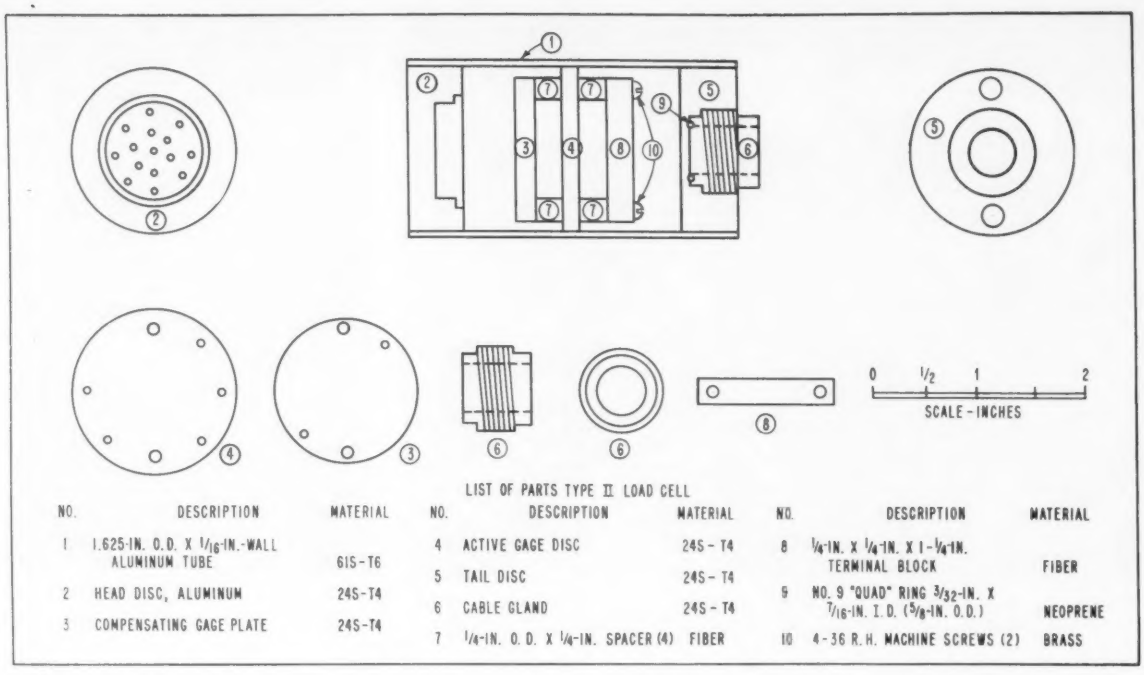
Roof Bolt Tension Indicators

One device used to indicate roof bolt tensions after installation is the roof bolt compression pad, made by Goodyear Rubber. This device consists of two round ⅜-in. steel plates with ⅜-in. of rubber vulcanized between them, and with a hole through the center to take the bolt.

In use, this assembly replaces the normal bearing plate under the head of the bolt, and under load the rubber squeezes out between the plates to a variable degree according to the tension in the bolt. A calibrated snap ring gage is used to measure the circumference of the rubber periodically as an indicator of this tension.

A second approach to the question of bolt tension indicators is the use of specially designed and calibrated lock washers[2]. The usual application of these washers is to indicate when the initial bolt installation tension is up to optimum.

A possible refinement of this procedure is to add a second lock washer in a series with the first. This second lock washer would have a closure load equivalent to any desired proportion of the yield load of the bolt. Thus, the safe operating range of the bolt would be bracketed by the two indicating washers, and any miner could tell at a glance if the



LIST OF PARTS TYPE II LOAD CELL

NO.	DESCRIPTION	MATERIAL	NO.	DESCRIPTION	MATERIAL	NO.	DESCRIPTION	MATERIAL
1	1.625-IN. O.D. X 1/16-IN.-WALL ALUMINUM TUBE	61S-T6	4	ACTIVE GAGE DISC	24S-T4	8	1/4-IN. X 1/4-IN. X 1-1/4-IN. TERMINAL BLOCK	FIBER
2	HEAD DISC, ALUMINUM	24S-T4	5	TAIL DISC	24S-T4	9	NO. 9 "QUAD" RING 3/32-IN. X 7/16-IN. I.D. (5/8-IN. O.D.)	NEOPRENE
3	COMPENSATING GAGE PLATE	24S-T4	6	CABLE GLAND	24S-T4	10	4-36 R.H. MACHINE SCREWS (2)	BRASS
			7	1/4-IN. O.D. X 1/4-IN. SPACER (4)	FIBER			

FIG. 15 Electric load cell is cemented in a borehole and wired to a modified Wheatstone Bridge. Changes in ground stress cause strains that are picked up by active gage disk (4). Compensating gage plate (3) allows for temperature correction.

bolt were overloaded or if the bolt were underloaded.

Borehole Load Cells

Although St. Joseph Lead Co. has made no use of borehole load cells as yet, considerable investigation has been done, and some cells have been designed, built, and tested. These cells, of the general type shown in Fig. 15, were patterned after some made by the Department of Mines and Technical Surveys in Ottawa, Canada[3,4]. Professor E. L. J. Potts of Durham, England, has done a great deal of work along these lines[5,6], as has Dr. Nils Hast of Sweden[7]. Work is also being done in the USBM Applied Physics Laboratories under the direction of Dr. Leonard Obert[8,9], and by E. R. Leeman of the National Mechanical Engineering Research Institute in South Africa[10].

Examples Prove Value

Baker 6100 Stope: This example of the use of rock mechanics instrumentation was a carefully controlled experiment in pillar removal, made possible by the application of systematic roof bolting. It has been completely described in a previous publication[11].

Leadwood No. 12 Shaft Area: This area (see p 100) has stood open as mined for many years, but recently began showing indications of progressive instability. Work was immediately begun to stabilize the area, including wrapping the old pillars with wire rope[12], building additional preloaded concrete pillars[13], and filling the worst areas with hydraulic tailings fills. To obtain a quantitative record of the ground movement in the area, an extensive network of convergence measuring stations was installed, and the tube extensometer was used to make regular periodic convergence determinations.

The graph on p 100 is the result of this work. Its slope indicates at once any trend towards stability or towards increased convergence and ultimate collapse. This same procedure is being used in other areas.

Pea Ridge Shaft Linings: As part of the new iron ore development of Meramec Mining Co., near Sullivan, Mo., two shafts are being sunk to a depth of 3000 ft. These shafts are circular and lined with concrete to a final diameter of 19 ft 1 in.

To detect possible increases in rock pressure with depth, and guard against excessive concrete stresses due to ground, water, or grout pressures, two types of measurements are being made. At vertical intervals of about 250 ft, stations are being installed to measure the shaft diameter in two directions, and the circumferential deformation in a horizontal plane. The horizontal tape extensometer is used for the former, and the Whittemore gage for the latter.

Results to date indicate an acceptable correspondence between the two measurements, but too few data are available as yet to establish any significant trends.

The authors wish to express their appreciation to the St. Joseph Lead Co. for permission to publish this article, and to the craftsmen who contributed their ideas and skill in producing the instruments described.

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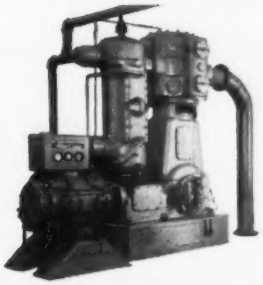

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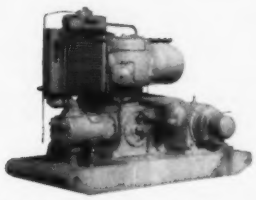

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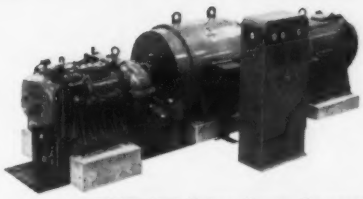

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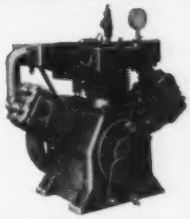

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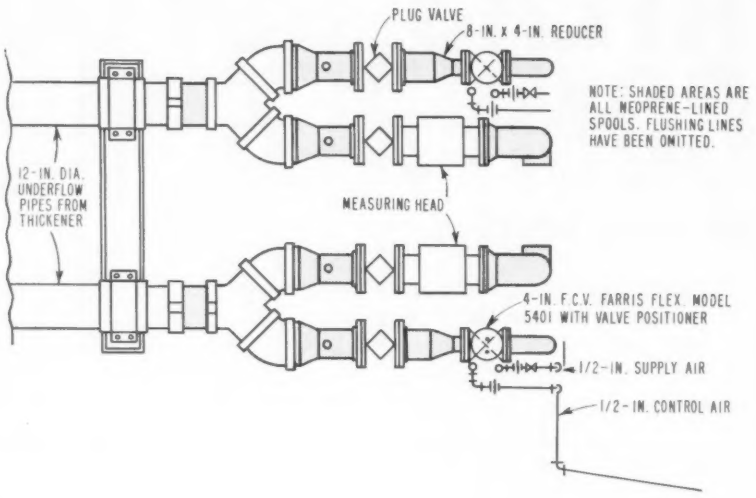
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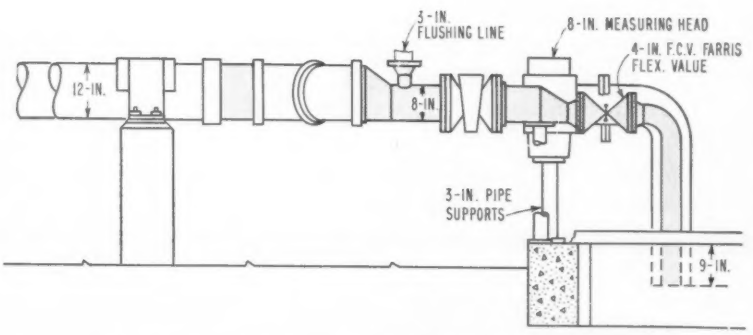
8-IN. x 4-IN. REDUCER
NOTE: SHADED AREAS ARE ALL NEOPRENE-LINED SPOOLS. FLUSHING LINES HAVE BEEN OMITTED.
12-IN. DIA. UNDERFLOW PIPES FROM THICKENER
MEASURING HEAD
4-IN. F.C.V. FARRIS FLEX. MODEL 5401 WITH VALVE POSITIONER
1/2-IN. SUPPLY AIR
1/2-IN. CONTROL AIR



WHEN pulp specific gravity changes, the detector unit at the measuring head generates an error signal. The signal goes to a recorder-controller (not shown), which proportionally positions the diaphragm valve on the 4-in. leg pneumatically.

Atomic Device Controls Pulp Density

WHAT MAY BE ONE of the first applications of an atomic device in the copper-mining industry is a radiation density-control unit recently placed in operation at Kennecott's Ray Mines Division's expanded reduction works at Hayden, Ariz. It controls automatically the density of the underflow from a 325-ft traction thickener that serves the new water-recovery plant.

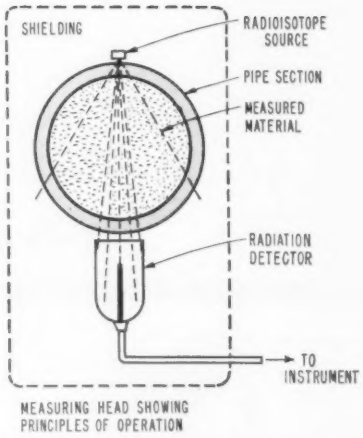
The thickener, which handles the sulphide portion of the tailings from the concentrator, recovers about 3000 gpm of water for reuse in the plant. The enlarged concentrator now treats 22,500 tpd of ore.

Kennecott, wanting a balanced and steady thickener operation with a minimum of human supervision, decided to automate control of the underflow density. Careful study and investigation by the company's engineering staff and by the equipment manufacturer resulted in the control system shown above.

As installed, the equipment detects, measures and records changes in percent solids. The pulp that the device governs varies from a minimum of 40% to a maximum of 57.5% solids; the solids themselves have a specific gravity of 2.6-2.7.

Principle of operation is the absorption of radiation by materials. When rays from a radioactive source are directed through a material or absorber, the amount of radiation that reaches the detector, placed opposite the source, will depend on the mass of the intercepting material. Changes in mass-per-unit-volume will change the amount of radiation absorbed, thus giving a basic measure of density, percent solids, specific gravity, etc.

At Hayden, this is accomplished by a density-measuring head, which contains at one end a radioisotope source and at the other a radiation detector. Tailings material flows between the two units. A second key unit is an air-operated diaphragm valve, to control the flow of



MEASURING HEAD SHOWING PRINCIPLES OF OPERATION

PRINCIPLE of detector unit is the absorbtion of radiation by the pulp.

pulp. Appropriate control and recording equipment serves both measuring head and diaphragm valve.

Underflow from the thickener is carried in two 12-in., Schedule-80 pipe lines, each terminating in a "Y". On the 8-in. leg of this "Y" is mounted the measuring head; on the 4-in. leg, the diaphragm valve. When pulp specific gravity changes, the detector unit generates an error signal. This goes to a recorder-controller, which modulates (proportionally positions) the diaphragm valve pneumatically. When below-normal pulp specific gravity is detected, the valve reduces the pulp flow.

The setup of the instrument assembly is based on average specific gravity of dry tailings. The control system was designed to operate under the following range of underflow rates:

	Max	Min
Tons Per Day		
Solids	16,748	12,793
Solution	12,379	9,456
Pulp	29,127	22,249
Gallons Per Minute		
Solids	1053	801
Solution	2063	1576
Pulp	3116	2377
Specific Gravity		
Solids	2.65	
Solution	1.0	
Pulp	1.56	

This table indicates conditions for maximum water recovery (i.e., maximum precent solids). At times the settling rate of the ore is such that a considerably lighter pulp is required, to maintain a clear overflow. The system has operated from 57% solids (conditions shown in table) down to 46% solids, to maintain a desirably clear overflow.

The installation can measure and record continuously with an accuracy of ±0.5% solids, when calibrated against the specific gravity of the underflow being handled.

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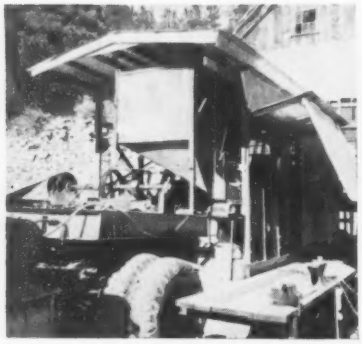
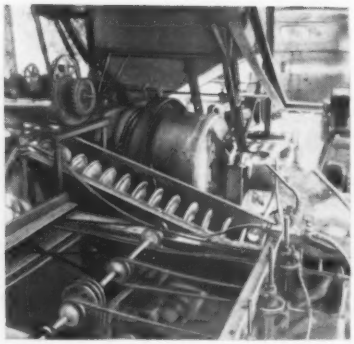




How Star Mining Co. Built a . . .

Home-Made Portable Mill for $5500

STARTING with a government-surplus low-boy, Star Mining Co. built a portable mill for $5500, excluding the cost of labor, according to Dave Aeder of Star Mining Co., Haines, Ore. The mill contains a host of equipment—crusher, bucket elevator, transfer belt., storage bin, ball mill, classifier, two flotation machines, filter and vacuum pump—suitable for a small miner or a group of small miners or prospectors.

The entire mill, with the exceptions of the crusher and truck, was hand-made and took about four months to build and assemble.

Ore is fed to an 8 x 12-in. jaw crusher, mounted over the rear duals of the low-boy. After crushing, the ore is lifted by a 4 x 6-in. bucket elevator to an 18-in. transfer belt near the roof of the truck (see illustrations), which discharges into a 4-ton storage bin near the front of the low-boy. The power for this section is supplied by an automobile engine independent of the rest of the mill.

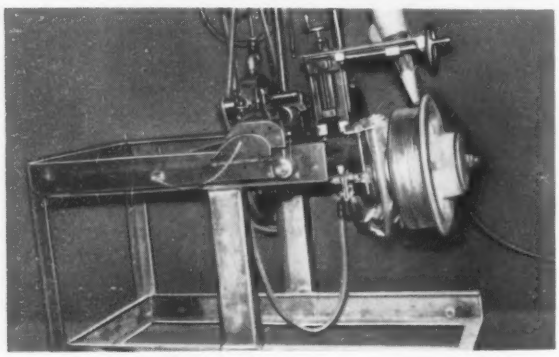
The balance of the mill is powered by the tractor through a secondary differential and belt drive to the main jack shaft.

The ball mill, classifier and two flotation machines are assembled on the main deck of the low-boy. The 30 x 32-in. ball mill has removable liners and rotates on roller bearings. The classifier is a 14-in. spiral with sealed babbit bearing bottom and ball bearing top. The flotation machines are 12 x 12 x 18-in. with 5-in. impellers. Auxiliary air, not normally needed, is supplied by the truck air system.

Also included is a dry reagent-feeder over the belt ore-feeder to the ball mill and a four-compartment wet reagent-feeder at the head of the classifier.

Other Portable Crushers Listed

In the January, 1961, New Products Digest section of E&MJ, two portable crushers were described. The first, Mobil-Mill, is made by Western Machinery Co. and has been installed in the Compania Minera Autlan, S.A. de C.V. manganese ore-dressing plant at Autlan, Mexico. The second, Ore Bee, is a truck-mounted gravity flotation mill manufactured by Shelton-Cheney Mining Co., Edmonds, Wash.



Welder Saves $5000 Per Year . . .

Rebuilding Mine Car Wheels

IDARADO MINING CO. found it could save over $5000 per year by rebuilding its mine car wheels instead of replacing them with new ones. The welding equipment required for this operation cost only $1300, plus the cost of a home-made fixture.

Replacement wheels cost $51 each. Total cost of rebuilding worn wheels to original size is $25.25 each. The saving of $25.75 each, when multiplied by the 200 wheels used each year, represents a total annual saving of over $5000.

The welding equipment used is a semi-automatic submerged arc welder. This welder feeds a continuous electrode from a 60-lb coil through a cable and welding gun into a flux-covered arc; it controls the feed speed so that a constant arc length is maintained; it is equipped with meters so that exact settings can be made to perfectly control the quality of the deposited weld metal; and a 600-amp motor-generator provides welding current for the automatic welder.

The fixture has a sturdy stand fabricated of channel iron. All the working parts mount on a single frame that pivots in the stand, so that the wheel can be positioned properly for welding both the face and the flange. A motor turns the shaft through a variable speed drive. The bracket that holds the welding gun adjusts horizontally and vertically for proper alignment over the work. The photo at the left shows the frame position for welding the face.

The operator welds the face of the wheel first. With the wheel fixed on the horizontal drive shaft, he aligns the welding gun over the work, fills the flux cone, and starts the arc and the drive motor. He makes a complete revolution of the wheel without changing the position of the welding gun. As the arc reaches the starting point, he moves the gun across the face of the wheel about 5/16 in. so that the weld bead feathers into the preceding bead to give a smooth surface. This process is continued until there is a complete layer of weld deposit over the entire face. Usually two layers deposited in this manner are sufficient to bring the wheel back to its original size. On badly worn wheels, additional layers are necessary to rebuild the wheels to proper size.

After the face has been brought to gage size, the operator tilts the fixture forward to weld the flanges. This is not always necessary as the flanges do not wear as severely as the faces. Starting at the face side of the flange, he works to the outside edge with a stepover procedure similar to that used on the face.

The wear resistant, but machineable, deposit on the wheels depends on the welding materials used. Idarado uses Lincoln Electric's H-535 hardsurfacing flux and L-60 mild steel electrode. By adjusting the welding procedure, they were able to develop deposits that have the maximum wear resistance consistent with the degree of machineability they require. The surfacing is a medium carbon, low alloy material.

Using 360-amp welding current and 22-in. per minute travel speed, the average welding time per wheel is one hour and fifteen minutes with another fifteen minutes required for the setup. Machining time averages two hours per wheel. Total material costs are $4.25 per wheel.

AT HOME ON THE "RANGE"

If there's an 9-yard mining shovel in your future, make it a Marion 181-M.

Here's a husky machine with the traditional strength, power and endurance of Marion mining shovels—plus small machine cycle time for an extra payoff every day.

The 181-M has a combination of design, construction and performance features that can lower your costs and add to your profits.

If you haven't seen Bulletin 439 on this 9-yard Marion, write for your copy today.

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HOW TO TAKE TIME AND WORK OUT OF PIPE LINE INSTALLATION

NAYLOR Wedgelock couplings make a positive connection, securely anchored in standard weight grooved ends.

To help you get the job done faster, easier and more economically, NAYLOR offers a pipe and coupling combination to simplify pipe line installations.

NAYLOR's exclusive lockseamed, spiral-welded structure gives you pipe that is light in weight without sacrifice of strength and safety. It's easy to transport, handle and install—saves time, trouble and money right down the line.

WEDGELOCK couplings fit into this economy picture, too. They simplify and speed connections since a hammer is the only tool required to connect or disconnect them, and joints can be made up with only one side of the pipe in the open.

Whether it's air, water, tailings or ventilating service, it will pay you to look into this dependable combination.

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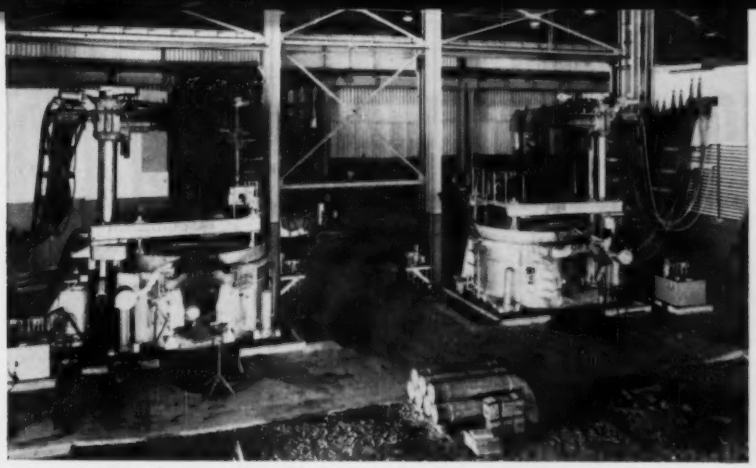
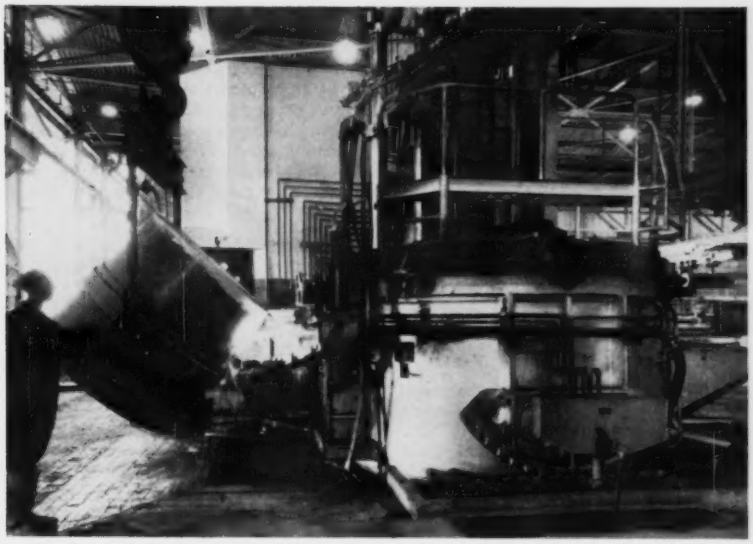
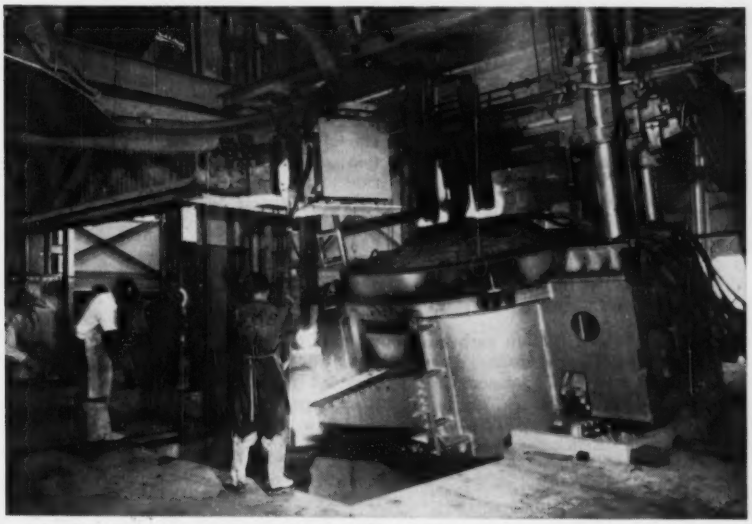


Two Lectromelt cold-melt batch furnaces melt gray iron.



Molten metal is transferred to Lectromelt duplexing furnace through special duck-bill receiving spout.



Duplexing furnace is tapped into ladles which are conveyed to pouring floor.

Lectromelt furnaces in action

at Sao Paulo foundry

Efficiency keynotes the layout of Lectromelt furnaces at this South American gray iron foundry. The two Lectromelt 5000-KVA cold-melt furnaces have fast charging, raise-and-swing roofs and superstructures. Each melts and taps in excess of 9 tons of iron in 1½ hours. The duplexing furnace, designed for fast handling of molten metal, superheats and adjusts the analysis of more than 20 tons of iron per hour.

For productivity in your melting, contact Lectromelt Furnace Division, McGraw-Edison Company, 314 32nd Street, Pittsburgh 30, Pa.

WHEN YOU MELT... Lectromelt® McGRAW EDISON

WHAT'S NEW IN PATENTS

OLIVER S. NORTH

U. S. PATENTS

Mining

In this process for the solution mining of underground beds of salt, sulphur, and other water- or acid-soluble minerals, pillars are left in the mineral bed to support overlying strata. J. L. Huitt and A. J. Teplitz, assigned to Gulf Research & Development Co. U.S. 2,966,346.

Metal and Mineral Processing

Simple yet efficient method and apparatus for recovering gold from sand or other alluvial materials, whereby the water can be saved and re-used. Alternating centrifugal and centripetal forces are manually applied to an open-topped vessel. W. C. Evand and R. E. Neuberg. U.S. 2,964,188.

Device for feeding pieces of material, particularly uranium ore lumps, in a single line or row to facilitate sorting or inspection thereof. L. H. Robock. U.S. 2,966,250.

In this apparatus for separating and concentrating the various minerals contained in black or heavy sands, need for large storage tanks is eliminated and the sand is pumped only once, that being when the material is initially picked up. E. A. Hobart, assigned to Hobart Bros. Co. U.S. 2,966,262.

Design for a mineral-pulp froth flotation machine having improved aeration action provided by a rotary impeller surrounded by stationary scrubbers, whereby the ore particles are scoured and the slimes removed. H. W. Coke. U.S. 2,966,266.

In the recovery of thorium, uranium, zirconium, and molybdenum values from aqueous mineral acid solutions, the solution is contacted with phosphorylated cellulose, and the metals recovered from the cellulose by elution or by heating in acid. N. F. Kember, assigned to U.K. Atomic Energy Authority. U.S. 2,966,393.

Method for concentrating phosphate values in fractions remaining after the recovery of larger particles by washing and primary classification of Florida phosphate ores. A concentrate containing at least 70% B.P.L. is produced by a process of negative-ion treatment, rougher concentration, hydraulic classification, and flotation. C. M. Goin, assigned to American Agricultural Chemical Co. U.S. 2,967,615.

In a process for recovering rhenium values from molybdenum concentrates obtained in the flotation treatment of low-grade copper sulphide ores, the concentrate is roasted, the resulting calcine is slurried with a mineral acid, and the slurry is heated in two stages. Rhenium oxide is recovered from the vapors. S. R. Zimmerley and E. E. Malouf, assigned to Kennecott Copper Corp. U.S. 2,967,757.

In the elimination of carnallite impurity from sylvinite ore, the ore is pretreated with a brine saturated with respect to sodium chloride and potassium chloride but not with respect to magnesium. The carnallite is selectively dissolved out, leaving a material suitable for froth-flotation treatment for recovery of a commercial sylvite product. H. P. Clark and A. Adams, assigned to International Minerals & Chemical Corp. U.S. 2,968,525.

CANADIAN PATENTS

Mining

In the underground solution mining of water-soluble mineral salts such as salt, carnallite, kainite, and sylvinite, the stratum is fissured, and the fissures channeled by high-pressure flushing with a solvent containing a number of inhibitors to prevent the solvent from becoming quickly saturated near the input well. A. W. Hanson. Dec. 17, 1960. Canadian 611,176.

Metal and Mineral Processing

Process for recovering iron, sulphur, and base metal values (such as copper, lead, and zinc) from pyrrhotite and like sulphide ores high in iron. Metallic iron or iron oxide is admixed with the ore, and the mixture is heated to drive off a portion of the sulphur present and render the remaining iron sulphide soluble in dilute mineral acids. The calcine is acid-leached to reduce the iron content substantially and produce a residue suitable for smelting. P. J. McGauley, assigned to Chemetals Corp. Dec. 6, 1960. Canadian 610,200.

In the direct reduction of iron-oxide ore to obtain steel or pig iron containing up to 5% carbon, a high-grade ore or ore concentrate is introduced into a molten bath of iron and carbon in an electric furnace heated by low-frequency induction. Reduction of the ore is effected principally by the carbon in the bath. Ore and carbon are introduced into separate basins connected by ducts. A. De Sy. Dec. 20, 1960. Canadian 610,747.

To produce a refined lithium carbonate, spodumene ore is sulphated, and the resulting lithium sulphate is extracted with water and reduced with a gas. The lithium sulphide thus formed is carbonated, and the lithium carbonate is recovered from the bicarbonate liquor by precipitation. T. E. Dwyer, assigned to Tholand, Inc. Dec. 20, 1960. Canadian 610,813.

In a relatively low-cost tunnel kiln of the type used for the production of sponge iron from iron oxide ores, the cooling effect is achieved in a shorter cooling section than usual. This section is divided into separate indirect recuperative and direct cooling zones in end-to-end relationship. P. E. Gummeson and M. Mathiesen, assigned to Aktiebolaget Hoganasmetoder. Dec. 20, 1960. Canadian 611,100.

In the recovery of contained titanium values, effluent liquors from a titanium ore chlorination operation or similar process are filtered through a graded bed of rutile, ilmenite, titanium slag, or other insoluble titanium material. Rutile is preferred for the upper layer of the bed. R. B. Mooney, assigned to Imperial Chemical Industries Ltd. Dec. 27, 1960. Canadian 611,307.

An economical and efficient grate for use in an iron-oxide ore sintering apparatus consists of a flexible open-mesh chain-type hearth made up of articulated lengths that can expand and contract individually, thus eliminating the warping and cracking frequently encountered with the usual heavy cast iron grates. F. J. Boron, assigned to American Brake Shoe Co. Dec. 27, 1960. Canadian 611,527.

BRITISH PATENTS

Metal and Mineral Processing

In a process for separately recovering uranium, iron, and aluminum values from Chattanooga shale and like low-grade ores, the ore is chlorinated, the metal chloride vapors contacted with alumina to separate and recover the uranium values, and the remaining vapor contacted with ferric oxide to form aluminum oxide, which is recovered. The final vapor is oxidized to form ferric oxide. Assigned to U.S. Atomic Energy Commission. Dec. 7, 1960. British 855,-811.

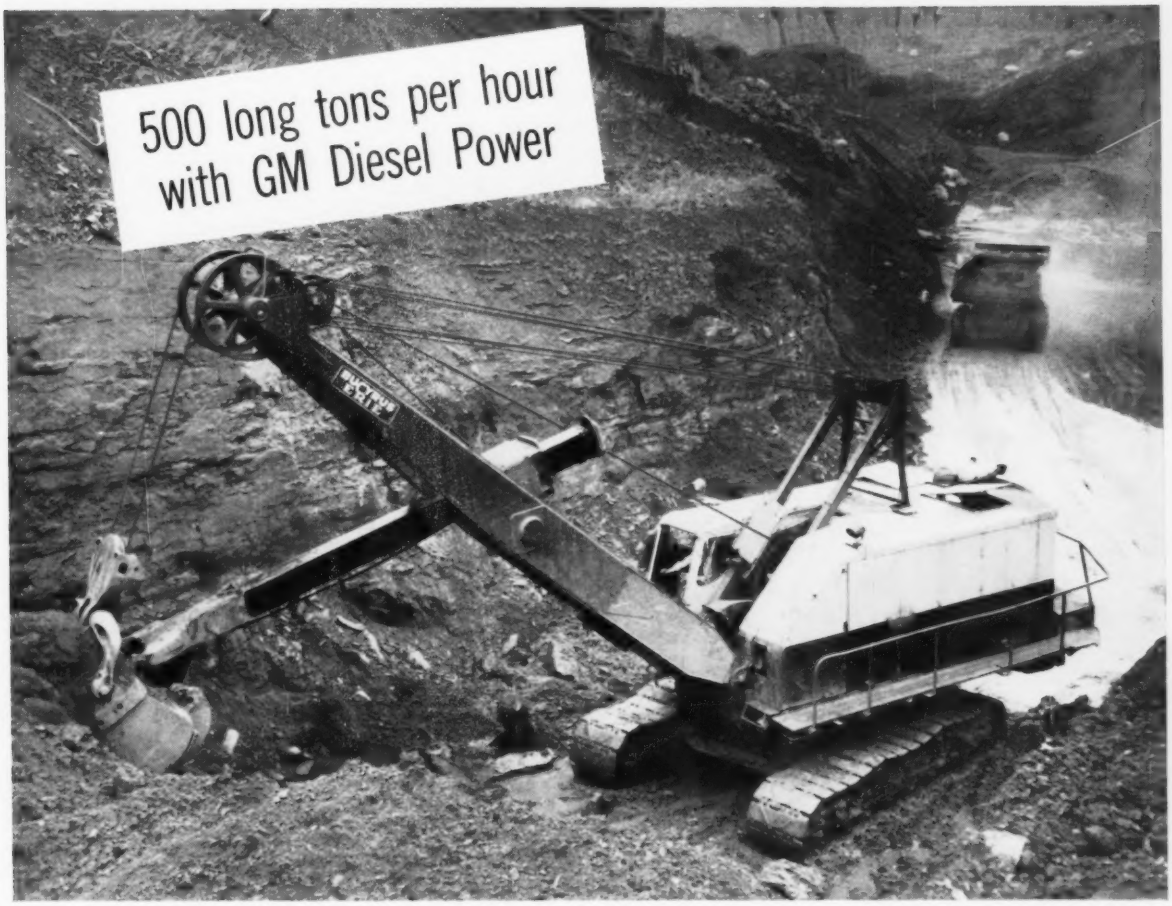
In the separation of columbium values from associated tantalum, the columbite ore is chlorinated in the presence of a carbonaceous reducing agent. The chlorination temperature is maintained low enough that the vapor produced contains predominantly columbium oxychloride and a small amount of columbium oxide. Assigned to E. I. du Pont de Nemours & Co. Dec. 14, 1960. British 856,306.

In a method for sintering iron oxide ores or ore concentrates in a wet condition without a preliminary drying step, the wet raw material is fed onto the sintering band and then covered with a layer of recycled dried and preroasted material from a previous sintering operation. Assigned to Metallgesellschaft A.G. Dec. 21, 1960. British 856,838.

Design for an improved separating table for recovering gold or other mineral values from ore slurries by making use of specific-gravity differences. The table has a cascade of ribbed surfaces along its length. Flotation or wetting agents may be added to assist in the separation. Assigned to Denver Machinery Co. (Prop.) Ltd. Dec. 21, 1960. British 856,984.

Mr. North is patent consultant, Washington, D.C.

GET REAL PRODUCTIVITY—GET A GM DIESEL



When you can get a shovel to move 500 long tons per hour—4,000 long tons every eight-hour shift—you're getting *real* productivity.

And that's exactly what one of the big mining companies on the Mesabi Range is getting with their Bucyrus Erie 71B shovel powered by a "Jimmy" Diesel.

The unit is used for a variety of jobs —is easy to move—saves a lot of time over electric-powered shovels because it has no electric cables to drag around.

Its performance record is one reason why this company also operates scores of GM Diesel-powered units—drills, pumps, earthmoving vehicles, as well as shovels. They report over 18,000 hours on some "Jimmys" with no overhauls, say that more of the GM Diesels in their earthmovers are over the 15,000-hour mark with no major parts replacements.

Got a power problem? Not getting the work you want from your equipment? Call your GM Diesel Distributor. He's part of a coast-to-coast network of "engine people" you'll find in the Yellow Pages under "Engines, Diesel." Write direct if you prefer—we'll send you the information you need.

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EXPLOSIVES

ENERGY...

vs. Mechanical Energy

Cheaper blasting materials and improved drilling equipment have reduced the cost of explosives energy to the point where it is doing work formerly reserved for mechanical equipment. By putting more of this low-cost explosives energy to work, machinery operates more efficiently, costs are lowered all along the line.

Smart, profit-minded operators are taking a closer look at the cost of mechanical energy vs. explosives energy and they are coming up with important savings in machinery, manpower, and time—for example:

In coal stripping, explosives force is used to move up to 50% of the overburden directly on to the spoil pile. Mechanical handling costs are reduced, and coal is uncovered more rapidly.

In open pit ore mining, explosives factors are being designed to gain additional fragmentation. Much of the material by-passes the primary crusher. Production is speeded, overall costs lowered.

In quarrying and construction, operators are finding it no longer pays to blast rock just hard enough for equipment to handle it. They are taking advantage of lower drilling and blasting costs to gain more fragmentation and displacement. And in the process they are making important savings in wear on crushers, dipper teeth, wire rope, and truck bodies. They are reducing operating costs, eliminating production delays.

The economics of drilling and blasting have changed. Looking for ways to reduce blasting costs alone is not enough. The real savings come when you look at explosives energy as a way to reduce overall operating costs.

For a closer look at some of the ways explosives energy can lower your costs all along the line, look to Atlas' full line—the only full line in the industry. Expanded plant facilities are now in production at Joplin, Missouri to assure ready availability of all products. And to give you faster, more flexible local service, new distribution facilities are being established coast to coast. Call in your Atlas Representative. His experience with the newest advances in explosives, blasting agents, and blasting techniques can help you measure the relative economy of explosives energy vs. mechanical energy in your operation.

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ATLAS EXPLOSIVES

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that simplifies speed reduction

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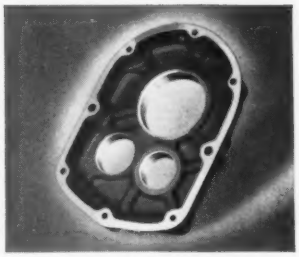
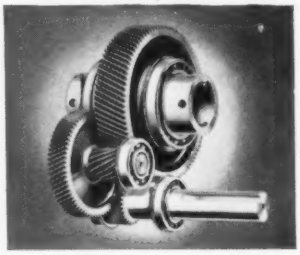
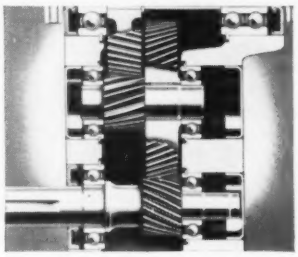
Dodge Manufacturing Corporation, 3100 Union St., Mishawaka, Ind.



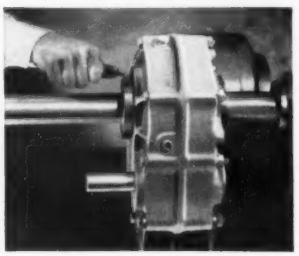
Rugged, semisteel housing holds bearing seats in line for entire life of unit. Laughs at loads. Corrosion resistant.



AGMA rated helical gears. Soft cores withstand shock; hardened surfaces defy wear. Teeth are crown shaved.



Gears are located *between* bearings and carry their loads without strain. Longer life, higher efficiency.



Unit slides completely onto shaft and locks on *both* sides of housing. This baby stays *put*—runs truer longer.

The Products with the Pluses... **DODGE**

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CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained by Dodge he can give you valuable assistance on new cost-saving methods.

PERSONALS

Joao Agripino Vasconcellos Maia will be Brazil's first Minister of Mines and Energy. The new ministry was approved by Brazil's congress last year to become effective on the advent of the new Janio Quadros government. Formerly mining and power matters were under the jurisdiction of the Ministry of Agriculture.

Agripino

Agripino, a member of the conservative National Democratic Union party from the tungsten-rich state of Paraiba in Northwest Brazil, was opposition leader in congress during the previous administration.

Professor Eugene P. Pfleider, head of the School of Mines & Metallurgy, has been elected chairman of the Minnesota section of the American Institute of Mining, Metallurgical and Petroleum Engineers. Pfleider has been active in the affairs of the Institute, having previously been chairman of the Mining, Geology and Geophysics section of the national organization. He is an authority on the development of large scale mining projects, and is currently a consultant for two of the large taconite developments in Minnesota and Labrador.

Edmund C. Bitzer, consulting metallurgical engineer from Golden, Colo., recently returned from a stint in Yugoslavia as an advisor for the U.S. International Cooperation Administration. He spent 14 months at a lead-zinc mine 150 miles southwest of Belgrade, where he helped boost production 40% as a result of mechanical improvements and application of the latest mining techniques.

Bitzer has spent many of his 30 years as a metallurgical engineer overseas. During the 1930's he worked in the Philippines for the Benguet Consolidated Mining Co. and in Malaya for the Raub Australian Gold Mining Co. A graduate of the Colorado School of Mines, Bitzer has also served as metallurgical advisor in Washington to the Atomic Energy Commission.

James M. Huffman, former mine foreman, kiln foreman, mine superintendent and production superintendent, has been named plant manager of National Gypsum's Kimballton, Va., plant.

Earl A. Garber has been named chairman of the board of Harbison-Walker Refractories Co. He is succeeded as president of the company by **A. Brent Wilson.**

Graber began at Harbison-Walker as assistant foreman in the mines. Working his way up, he occupied various positions in the mines, in the works department, as foreman and plant superintendent and as district superintendent. He was later manager of Northwest Magnesite Co., a subsidiary of which he was named vice-president and general manager in 1944. By January 1947, Garber had become vice-president and general manager of Harbison-Walker, and since July 1, 1948, has been president.

Dr. Duncan S. Heron, of Duke University, is the new president of the Carolinas Section, American Institute of Mining, Metallurgical and Petroleum Engineers. He served as vice-chairman during the year just ended, and succeeds Earl C. Van Horn, consulting geologist of Murphy, N.C.

J. M. Henneck moves from vice-president to president, American Silver Mining Co., succeeding **H. C. Snyder,** who resigned.

Ernest R. Rodriguez, former health and safety engineer, U.S. Bureau of Mines, accident prevention and health division, Denver, has been named chief of the Bureau's office of mining research at Spokane. The new Spokane research office is one of six set up under a reorganization which began in 1959. It will emphasize research on artificial stabilization of underground mine openings.

Hitch

Hardinge

J. D. Hitch, Jr., director of Dorr Oliver Inc., has been named president of the Process Equipment Manufacturers Assn. **Harlowe Hardinge,** president of Hardinge Co., will be vice-president of the new organization which has been formed to assist member companies in improving the effeciency of their operations, thereby rendering increased service to their customers.

Professor Donald H. Yardley of the Mineral Engineering staff of the University of Minnesota has been given a National Science Foundation grant for the sum of $25,500 to make a study of trace element distribution in a swamp environment. The objective of this work is to determine the nature of the geochemical distribution patterns of certain trace elements in a swamp environment overlying a mineralized contact. Another aspect is to investigate the factors which affect or control geochemical mobility and distribution in such an environment, and relationship to neighboring environments overlying a similar geologic setting.

Dr. Joseph Zimmerman has resigned as editor-in-chief of the Daily Metal Reporter a post he held for more than 40 years. He has joined Miles Metal Corp., New York, as a consultant.

Zimmerman is recognized internationally as a metal economist and market analyst. He is a member of: Phi Beta Kappa; Mining and Metallurgical Society of America; American Institute of Mining, Metallurgical and Petroleum Engineers; American Academy of Political and Social Science, and the Mining Club.

P. V. Bethurum has been named mill superintendant of the Texas Uranium Mill of Susquehanna-Western, Inc. The 200 tpd uranium mill, the first such facility in Texas, is now being constructed at an estimated cost of $2-million, and is expected to begin operation in April of this year. Bethurum was formerly production foreman of the company's Riverton, Wyo., mill.

Dr. Rene Victor Marie Perrin, of Paris, noted Ugine authority, has been elected to honorary membership in the American Institute of Mining, Metallurgical, and Petroleum Engineers. Also elected to honorary membership were two Americans: **Carl E. Reistle,** of Houston, Texas, executive vice-president of Humble Oil & Refining Co. and former AIME president; and **Dr. John Fairfield Thompson,** of New York, honorary chairman of The International Nickel Company of Canada, Ltd., and of its U.S. subsidiary The International Nickel Co., Inc.

Bodge Irwin has been named general manager of Messina Transvaal Development Co. Ltd. He had been assistant general manager and, previously, underground manager.

Dr. Stanley E. Jerome has been named associate director of the Nevada Bureau of Mines and the Nevada Mining Analytical Laboratory, public service agencies of the Mackay School of Mines, University of Nevada. Dr. Jerome will direct research projects and supervise activities of the Bureau and the Lab both on campus and in the field in their continuing program to assist Nevada mining men and minerals industries through exploration, research into new uses for known minerals, experimentation with new mining techniques and dessemination of information.

Dr. Jerome comes to his new post from Hunting Geophysical Services, Inc., Salt Lake City, where he was consulting geologist. Earlier, he had served as district geologist for Bear Creek Mining Co. (Kennecott), and as chief geologist for Gulf Minerals Co.

Kenneth Wilson, for the past 17 years exploration geologist and specialist in problems of ownership and acquisition of property for exploration for American Smelting and Refining Company has resigned as head of that company's exploration office in San Francisco to establish his own consulting offices at 400 Montgomery Street in San Francisco and in Menlo Park, Calif.

Wilson

PERSONALS *(Continued)*

Felipe de Lucio, here being congratulated by **Mrs. John Burgess,** chairman of the educational committee of the WAAIME, Lima, Peru, was recently awarded a year's post graduate study at the University of Arizona by Impact, Inc., which is owned and controlled by employees of Tennant. De Lucio was one of two 1960 graduates of the National Engineering University of Lima to be awarded a three-year scholarship for graduate study in the U.S. by the Lima section WAAIME.

John C. Bayless has been named manager of engineering geology operations for Doeringsfeld, Amuedo and Ivey, Denver, consulting geologists. Bayless had formerly been geologist, project administrator and director of customer relations for Abrams Aerial Survey Corp. He has also served as a petroleum geologist for Texaco, Inc., engineering geologist and teacher at Michigan State University.

H. B. James has been appointed secretary-treasurer and director of American Exploration & Mining Co., San Francisco, a wholly-owned subsidiary of Placer Development, Ltd. He succeeds **D. de S. Duke** who retired January 1 after 27 years active service with the Placer group.

Dr. Jerome B. Cohen, assistant professor of materials science at Northwestern University, is 1961 winner of the Robert Lansing Hardy Medal of the American Institute of Mining, Metallurgical and Petroleum Engineers.

The medal is given in recognition of "exceptional promise" in a man under 30 in the fields of "mineral beneficiation; extractive, physical or adaptive metallurgy; and metal processing."

The national award was presented to Cohen, 28, at the January meeting of the AIME Chicago section.

While a graduate student at MIT, Cohen was a Kennecott Copper Co. fellow. After receiving his doctorate there in 1957, he received a Fullbright Fellowship to study with Professor A. Guinier at the University of Paris, where he worked with x-ray diffraction methods. For the 1958-59 year he was senior scientist with Avco Manufacturing Co., working on design of nose cones for the Titan and Minuteman missiles.

As assistant professor at Northwestern, Cohen now has five graduate students working with him using x-ray diffraction equipment to study such phenomena as the effect of shock waves on metals. The group is using single crystals, and subjecting them to shocks causing 5-million lb per sq in. stresses. This process changes metal structure greatly, Cohen notes.

The extractive metallurgy award of the Metallurgical Society of the AIME goes this year to **Professor Herbert H. Kellogg,** of the Henry Krumb School of Mines, Columbia University, and **Sujit K. Basu,** a graduate student at Purdue University.

The award, presented in St. Louis during AIME's 90th annual meeting, is for their paper on "Thermodynamic Properties of the System Pb-S-O to 1100 K," published in the Society's "Transactions."

Professor Kellogg, a graduate of the School of Mines before joining the Columbia faculty in 1946, specializes in the application of physical chemistry to metallurgical processes.

A former director of the Metallurgical Society, he has been chairman of the Extractive Metallurgy Division. He was also formerly chairman of the Titanium Advisory Committee of the Department of Defense.

Basu, a native of Calcutta and a mining engineering graduate of the University of Calcutta, taught in the Metallurgical Department of the Indian Institute of Technology in Kharagpur. He obtained his master's degree in mineral engineering at the Henry Krumb School of Mines in 1958 and now is a graduate student in the Department of Metallurgical Engineering at Purdue University.

At the annual meeting of the Nevada Mining Assn., Inc., held in Reno on January 27, the following members were elected to serve as directors for the ensuing term: **Henry S. Curtis,** plant manager, American Potash & Chemical Corp., Henderson; **E. B. Douglas,** general manager, Manganese, Inc., Henderson; **Roy A. Hardy,** owner, Adelaide-Crown Mine, Humboldt County; **Robert O. Jones,** manager western division, The Standard Slag Co., Gabbs; **John C. Kinnear, Jr.,** general manager, Kennecott Copper Corp., Nevada Mines Div., McGill; **A. E. Millar,** general manager, The Anaconda Co., Yerington Mine, Weed Heights; **Edward L. Pine,** president, Isbell Construction Co., Reno; **H. P. Willard,** works manager, western division, Basic Incorporated, Gabbs; **S. H. Williston,** executive vice-president, Cordero Mining Co., McDermitt.

Ervin E. Waulters was recently named Chief Geologist in the exploration department of the Western Division of Vanadium Corporation of America. He has been associated with V.C.A.'s Western Division in engineering, mining and geology since 1951. Prior to that, Mr. Waulter served with Union Mines Development Corp. and the Atomic Energy Commission.

Waulters

Walter R. C. Russert, assistant superintendent of mines for The Anaconda Co., Butte, Mont., will retire February 1. He is an alumnus of MIT and Yale University, and received his Ph.D. in mining engineering from Yale in 1919.

Dr. Hamilton McLaughlin, Regent of the University of Calif., and noted mining engineer, has been named by the American Institute of Mining, Metallurgical and Petroleum Engineers, to receive the 1961 Charles F. Rand Foundation Award.

Dr. McLaughlin is chairman of the board and chief executive officer of the Homestake Mining Co., and is a member and foremer chairman of the Board of Regents of the University of California. He is an honorary member and former president of the Institute.

OBITUARIES

Dr. William C. Haldane, 83, pioneer in the development of the rare metals industry on Colorado's Western Slope, died at Denver, January 13. He was a retired vice-president of U.S. Vanadium Corp., now Union Nuclear Corp.

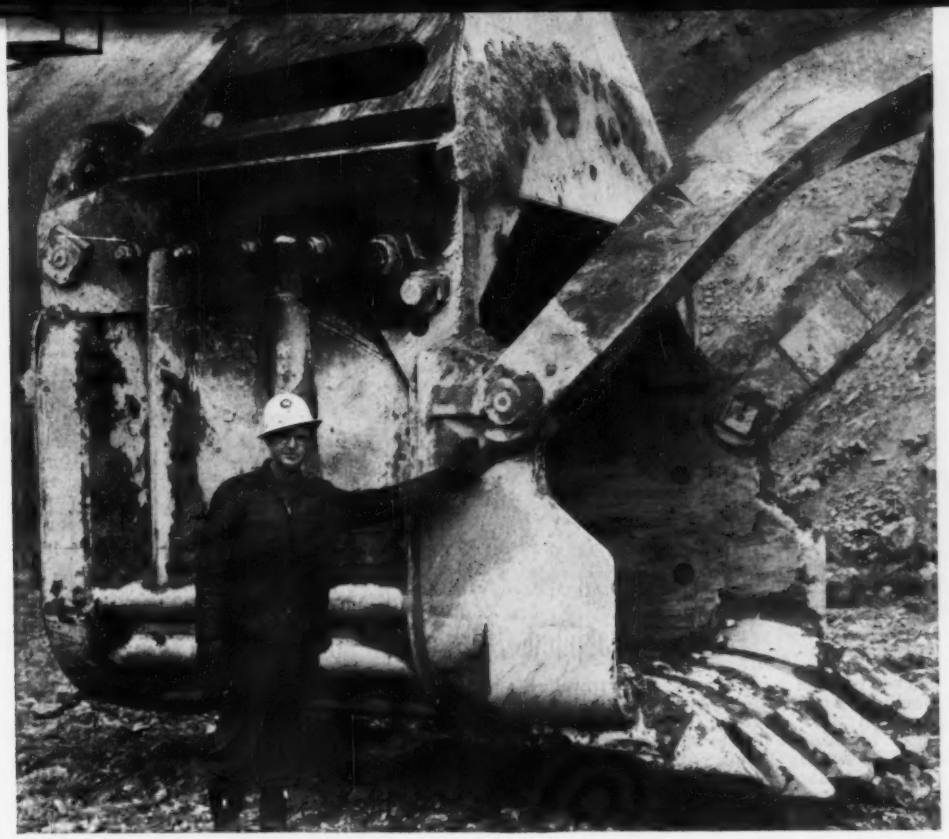
Haldane and an associate, Dr. Herman Fleck, a chemist, conducted pilot work in methods of acid leaching and concentration of ores which became the basis for uranium development at Slick Rock, Colo. Their methods are now being used by several uranium firms.

He was a faculty member at Colorado School of Mines from 1900 until 1913 and was acting president for another four years.

After resigning at the college, Haldane became a consulting engineer in Denver where he practiced until 1936. He then joined U.S. Vanadium as superintendent of its Uravan, Colo., plant. He moved to New York as the corporation's vice-president five years later and retired in 1947. Returning to Colorado, he became one of the organizers of Minerals Engineering Corp., from which he retired in 1954.

Tom P. Harsh, 90, well-known mining engineer, died January 6 of a heart attack in Long Beach, Calif. Harsh was associated with the Stonewall Gold Mining Corp. in Lincoln, Mont., from 1935 until 1944.

He was graduated from the Golden, Colo., School of Mining in 1898 with a degree in mining engineering. He was well-known in mining circles in the Western part of the U.S., in Mexico and in British Columbia, where he had done extensive work in mining operations.



TEETH TALK

and they say a mouthful— (USS) "T-1" Steel shovel teeth outlast others five to one!

D. T. Van Zandt, plant manager of U. S. Steel's Michigan Limestone Division at Rogers City, Michigan, says, "USS 'T-1' Steel in our shovel lasts five times as long as conventional steel. In our quarry we found this out the hard way—by numerous breakdowns and precious time lost for repairs. Carbon steel teeth lasted 80 hours. An alloy lasted 160 hours. Now, with 'T-1' Steel, teeth life is 400 hours, and this is conservative! Each tooth costs roughly $100—and we used about 200 teeth a year. Now we save most of that money." ☐ The bucket lip, too, is made from USS "T-1" Steel. Vast improvement in service life resulted, with much less bucket weight. This means speedier shovel operation. Also—the bucket has added toughness in cold weather—for "T-1" Steel is tough and strong even down to 50° below zero F. Here's a single steel that will handle impact, abrasion and shock. Maintenance consists only of cutting plates into teeth and welding them. USS "T-1" Steel has a minimum yield strength of 100,000 psi and is weldable and workable. You can't beat it for this kind of work. ☐ United States Steel makes other brands of steel of high strength levels for a wide variety of applications: USS COR-TEN, USS MAN-TEN, USS TRI-TEN for 50,000 psi minimum yield point, in addition to a complete range of carbon and Stainless Steels. For more information write to United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

USS, "T-1", MAN-TEN, COR-TEN and TRI-TEN are registered trademarks

Steel . . . because it's tough
. . . because it's strong

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Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company

United States Steel

USS

SAUERMAN NEWS briefs

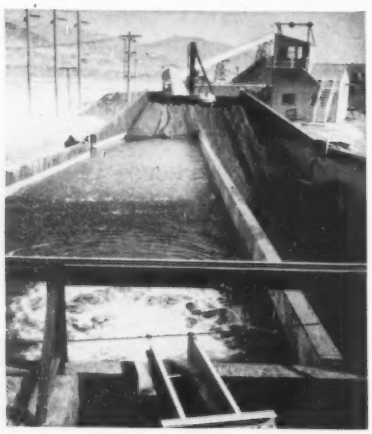
SAUERMAN BROS., INC.,
626 South 28th Avenue, Bellwood, Illinois
Linden 4-4892

Cableway-DragScraper Blends, Reclaims Stockpiled Ore

Over a million tons of iron ore may be stockpiled in the new facilities of a South American mining company. The DragScraper permits better blending of the ore and reclaims all stockpiled material that does not flow by gravity into two 3000-ftph. tunnel conveyors.

The 10-yd. Dragscraper is suspended from a carriage traveling on a track cable between two self-supporting towers. These travel on tracks paralleling the storage area. Despite the size of the Sauerman installation, it may be controlled by one man.

(Condensed from a forthcoming Sauerman News)



Efficient Slag Removal

A 4-yd. Sauerman DragScraper machine is incorporated in the waste slag disposal system of a large copper smelting operation. The slag is flumed into two dewatering tanks separated by a common wall. After a tank is drained, the slag is reclaimed by the DragScraper to a hopper at the head end. The DragScraper is remotely operated from a station above the hoist to provide good visual coverage of the installation.

The monorail-trolley assembly at the tail end provides lateral movement of the DragScraper. The monorail spans the tanks, and a Durolite single block on the trolley carries the backhaul cable. Shifting is handled by a motorized winch remotely controlled by the hoist operator.

The DragScraper reclaims to the hopper at about 250 tph. The hopper, in turn, feeds a conveyor belt which carries slag to the disposal area.

(Condensed from Sauerman News No. 155)

Handling Phosphate Ore

Ore concentrate is stockpiled and reclaimed as required to the foot of a bucket elevator by a Sauerman DragScraper Machine at a Southern chemical plant.

A self-propelled tail tower travels around the perimeter of the stockpile. The tower is shifted to change the line of operation. DragScraper haul length is 400 ft. The operator's station for the Sauerman hoist is located above the conveyors to give a clear view of the pile.

(Condensed from Sauerman News No. 151)

MORE NEWS AND INFORMATION

Issues of Sauerman News giving greater detail about the installations on this page are available on request. For more information on your materials handling requirements, contact Sauerman Bros., Inc., 626 S. 28th Ave., Bellwood, Ill. Linden 4-4892.

This Month *(Continued)*

Burgin Project Examines Lead-Silver Extension

KENNECOTT'S DEVELOPMENT DEPARTMENT at the Burgin shaft, East Tintic, Utah, has intersected a supposed extension of the Eureka Standard fissure. The extension, uncovered after driving off 311 drift, 1600 ft due west of Burgin shaft, first revealed a minor showing of lead ore in the quartz. As driving continued, this opened into a system of brecciated shale forming the hanging wall, with ore bearing quartz forming the foot wall. To date the fissure has been intersected to a length of 70 ft. Approximately 40 ft of this sector appears thick enough to be mined profitably.

The quartz segment assays at 15 oz of silver per ton, with lead 25%. Copper and tin values are fractional, but silver, based on one assay of a 7 ft shale ran 50 oz, with 4% lead.

The new fissure may be related to a zone in the northwest of Burgin shaft; there is a similarity of assay and deposition. If so, this could open up an additional 500 to 600 ft of proved reserve. Bear Creek is now confining its operations to exploration drilling from the surface into likely target areas as yet untapped by underground development. Meanwhile, Kennecott's development department has encountered very heavy ground in sinking a winze in that ore sector, 1000 ft out from Burgin shaft. Grouting is underway on the first station. A substantial flow of water with temperatures at 130° F has been encountered and is being adequately handled.

New Uranium Committee Names Newlin Chairman

THE URANIUM MINING and Milling Committee of the Atomic Industrial Forum—whose membership represents approximately 66% of the uranium mill production of the U.S.—recently appointed as chairman Richard S. Newlin, New York, vice president-operations of Anaconda.

The Forum is the association of the atomic industry, with membership ranging from mining companies producing the basic raw material, through the manufacturing chain to electric utilities operating nuclear reactors, shipbuilders interested in building nuclear-propelled vessels, universities, industrial companies and others using radioisotopes and other forms of nuclear energy. An effort currently is getting under way to enlist the support and participation of all companies in the industry.

A. P. Kibbe, Salt Lake City, president of Hidden Splendor Mining Co., was named vice chairman of the miners' and millers' group. Other industry leaders named are George H. Cobb, Oklahoma City, executive vice president of Kermac Nuclear Fuels Corp.; William B. Hall, New York, vice president of Vitro Corp. of America; M. H. Kline, Salt Lake

NUMBER

(1)

IN A

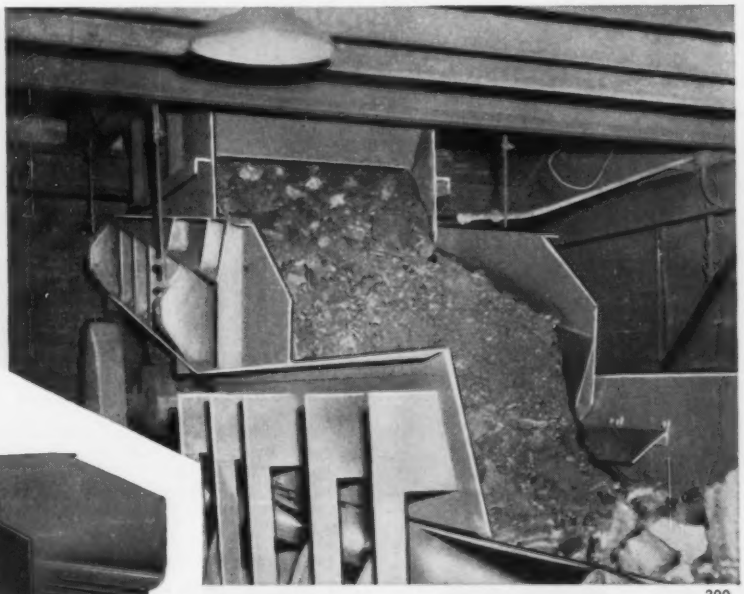
SERIES OF

FOUR

BIG CHIEF mine processes up to 2500 tons in two shifts . . . using SIMPLICITY vibrating pan feeders

At the South-East Coal Company's Big Chief Mine in Seco, Kentucky, 16 rugged Simplicity units are speeding up coal production. In this well-planned preparation plant are 2 vibrating feeders, 4 dewatering screens, 1 Os-A-Veyor picking table, 5 double deck gyrating screens and 4 single deck screens . . . all of them Simplicity machines.

The photo at right shows one of the Simplicity vibrating pan feeders at the start of the operation. By maintaining positive control of the run-of-mine coal entering the tipple, any interruptions in the processing cycle are eliminated. This tipple at Big Chief mine turns out ⅜" x 1" domestic stoker, ⅜" x 1¼" industrial stoker, ⅜" x 0" industrial carbon, 3" by 5" egg and 5" block . . . at a rate of 1250 tons per eight hour shift (or 2500 tons in a two-shift workday).



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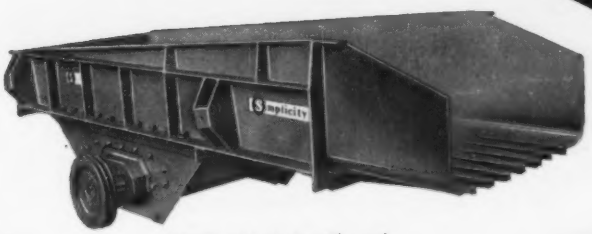

MODEL OA-10-N 42" x 12'

Simplicity vibrating pan feeders range in size from 1' x 4' to 6' x 20' . . . and will efficiently handle capacities up to 1000 tons per hour. Write today for new feeder catalog 571 or catalog #53, which describes Simplicity screening equipment.

SALES REPRESENTATIVES IN ALL PARTS OF THE U.S.A.

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FOR EXPORT: Brown & Sites, 50 Church Street, New York 7, N. Y.

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Newlin Named (*Continued*)

of America; Mitchell Melich, Moab, Utah, president of Uranium Reduction Co.; A. V. Quine, San Francisco, assistant to vice president, Utah Construction & Mining Co.; and Ross Thomas, Bartlesville, Oklahoma, vice president of Phillips Petroleum Co.

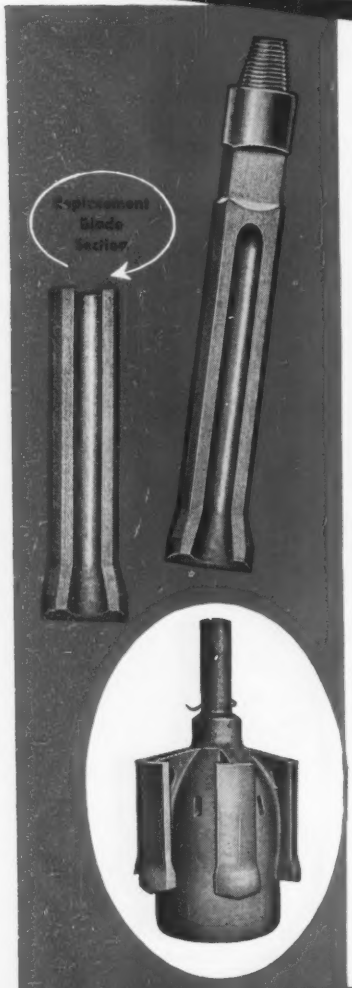
The newly formed committee will be engaged in a number of activities fostering the industry, whose output today exceeds in value that of many better known metals. Activities will include studies of near and long-term non-military markets for uranium in the U.S. and abroad; accumulating information on non-nuclear uses of uranium; promotion of health and safety practices in uranium mines and mills and the control of possible radiation hazards; the study of state and federal regulations affecting mining and milling operations and the effects of legislation on uranium markets.

Oxygen Process Boosts Swedish Steel Output

SWEDEN PLANS to invest $66.6-million in new plants and machinery during the first half of the 1960's, and $50-million per year for the last half of the decade. Most investment in metallurgical departments will be used to expand the Kaldo oxygen process, which has had great success in Sweden, and which will account for 22% of the 1965 output, compared with 4% in 1959.

Total steel production was 2.8-million in 1959, according to Ragnar Sunden, head of the Swedish Ironmasters' Assn. in a recent address. The 1960 output increased to 3.2-million tons. Between 1959 and 1965, steel output is estimated to rise by 63%, and exports, which were $150-million in 1959, are expected to rise to $300-million by 1965, and may exceed $400-million by 1970.

SPANG



BLAST HOLE BITS

Drill More Holes Per Bit, At Less Cost Per Hole

SPANG CHURN DRILL BITS, famous for long life and economy in the drilling of blast holes for the fragmentation of minerals or overburden, drill *more-holes-per-bit* at *less-cost-per-hole,* because they are fully heat-treated from end to end and have the *extra strength in pin and blade sections* to stand up under the toughest drilling conditions. They are made with semi-dressed ends for quicker, easier finish-dressing, in High Carbon, A.I.S.I. 4340, and Spang Molloy Steel.

Available also, as an added economy, are SPANG REPLACEMENT BLADE SECTIONS in the same grades of steel, and uniform forge section, for welding to pin and collar sections of original bits when long service has worn the integral blade to a point where replacement is desirable.

Anyway you look at it, SPANG BITS are your best buy for more holes at less cost per hole.

SPANG REAMER TYPE PILOT BITS FOR DRILLING LARGE DIAMETER HOLES

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Iron Ore Inventories Show Year-End Rise

CAUTION continues to be the by-word of forecasters in the iron ore-steel picture for 1961. A close up view of trends in the use of iron ore, based on the following 12 month chart, shows a continued rise in iron ore inventories in iron and steel plants across the U.S.

Although consumption has risen slightly in 1960 over 1959, an almost parallel rise in inventories has resulted. Consumption of foreign iron ore has increased steadily during 1960, whereas U.S. inventories of foreign ore are less than those from U.S. sources. (See E&MJ, February 1961)

U.S. Iron Ore Use and Consumption 1960—1959

(Millions of tons)

	1960	1959
Receipts at iron and steel mills (12 months)		
From Lake Superior district	**62.9**	43.2
From other U. S. sources	**15.0**	14.3
From Canadian sources	**10.8**	12.3
From other foreign sources	**24.0**	21.7
Total	**112.7**	91.5
Consumption in the U. S. (12 months)		
Ore from Lake Superior district	**53.2**	52.8
Ore from other U. S. sources	**15.2**	13.9
Ore from Canadian sources	**11.9**	10.1
Ore from other foreign sources	**21.9**	17.5
Total	**102.2**	94.3
Inventories in iron and steel plants (at end of Dec. 1960)		
Ore from Lake Superior district	**39.8**	30.1
Ore from other U. S. sources	**3.4**	3.7
Ore from Canadian sources	**7.1**	8.4
Ore from other foreign sources	**16.8**	14.7
Total	**67.1**	56.9

Steep Rock Seeks Support For New Iron Ore Prospect

STEEP ROCK Iron Mines Limited plans the development "in partnership with consumer interests on a royalty basis" of a major new deposit in the Lake St. Joseph area of northwestern Ontario,

Bethlehem Wire Rope in the Adirondacks. You're looking at a huge quarry in upstate New York. The hoist rope on the loading shovels is Bethlehem 1¼-in. Form-Set Purple Strand, Lang Lay, with IWRC. Many of the other loading shovels at this operation are rigged with hard-working Bethlehem Rope. Heavy-duty service like this is the best way to appreciate the dependable performance that only a top-quality rope can deliver.

There's a distributor of Bethlehem Rope near you, supplied by our nationwide network of wire rope mill depots

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for Strength
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Steep Rock (*Continued*)

President M. S. Fotheringham stated in the annual report to shareholders.

He said the property, which is slightly to the north of Steep Rock, appears capable of producing 3-million tpy of pellets and that it can support profitable open pit operation at this rate for at least 50 years. The company's stated objective is important royalty income without large capital expenditures.

The Steep Rock range itself, a major Canadian source of high-grade iron ore in the Lake Superior district, produces direct-shipping ores and ores treated to buyers' specifications from directly-operated mines and from Caland Mine under lease to Inland Steel of Chicago.

Marcona Will Pelletize Low Grade Ore

AFTER seven-odd years of production from the leached ore zones of the vast Marcona deposit in Peru, Marcona Mining Co. has begun construction of the first of a two-part $43-million beneficiation plant construction program to begin shipping from the much larger ore zones which make up the bulk of the deposit.

A $22.5-million mill, to be completed this year, will take the lean ores from stockpiles and from the pit for treatment and pelletizing. The new plant, to produce 1.3-million tons of concentrate annually, was started July 4, 1960 at San Nicolas Bay.

The plant includes many features required for future expansion. A new combination of truck roads and conveyor transportation system is being installed to allow ore to be hauled from the mine to a 3 km-long conveyor belt over the steep coastal benches, from which it will be trucked to the plant at San Nicolas Bay. The conveyor will probably be expanded in the future to provide a complete conveyor transportation system between the mine and San Nicolas. A new prestressed concrete loading dock is being-installed to provide shipping capacity up to 10-million tpy handling ships up to 45-ft draft. The 85- to 120-ft prestressed piling and beams up to 27 tons are being manufactured at a new prestressed manufacturing plant at the plant site. A new 10,000-kw diesel-driven generating plant is being installed.

The Marcona firm, composed of Utah Mining & Construction Co. and Cyprus Mines, is studying the design for the second part of the mill program, a $20.5-million upgrader to take the vast primary deposits which underlie the leached, sulphide and sulphate divisions of the orebody.

The crude primary averages 58% Fe and 2.5% S, compared with 60% Fe and 0.15% S in the leached zone.

The grinding section of the plant for primary ore will receive minus ½-in. ore and feed it to four 10x15-ft rod mills, each driven by 700 hp motors, and four 11x22-in. ball mills, driven by 1250 hp motors. The coarse fraction of the minus 10-mesh material will be classified in cyclones eventually to produce a shippable sinter concentrate rating 67% Fe, 1% S and 3% SiO_2. Fines will be rerouted to the ball mill to produce a 70% minus 325 mesh (plus 70% Fe) as pellet feed. One million tons of sinter and another million tons of pellets are to be produced annually.

The plant is so designed that additional equipment and facilities can be added to expand production in increments to an annual capacity of 10-million tons if and when desired without any interference to the present designed production.

Prior to the proposed expansion, new royalty and reserve arrangements were made with the Peruvian Government's Santa Corp. to guarantee reserves for the establishment of an iron and steel industry in Peru, also based on Marcona's ores.

OME Lists Mine Contracts

OME received 26 applications for minerals exploration assistance, entered into six contracts with mine operators, and issued certifications of discovery on five projects during the first-half of 1960, according to its fourth semi-annual report.

The report says that the net recoverable value of ore reserves discovered on DMEA projects had reached $935-million estimated at June 30 market prices, and that important additions are anticipated as the 15 DMEA contracts remaining in force are completed.

CHECK THE NEW

Connellsville

MINICAGE

(TRADE MARK)

The Service Elevator for Preparation Plants and Underground Installations

- REDUCE DOWN TIME
- ELIMINATE FATIGUE
- SPEED UP MAINTENANCE

This all-steel Connellsville MINICAGE with 1000 lbs. and up capacity travels the outside wall of an existing preparation plant . . . or may be designed for inside a future-planned facility. Operates automatically at speeds of 50 to 75 feet a minute.

The sturdy fabricated steel structure with pantograph-style gate is mounted in place and safely attached to wall. Drive assembly at top of structure is coordinated with the MINICAGE and level doors by a control system. Wall openings at levels have hinged safety doors.

The entire Connellsville MINICAGE installation complies with federal and state mining laws.

For additional information and details on the Connellsville MINICAGE and other elevators, cages, hoists and conversion units, write for Bulletin No. 200.

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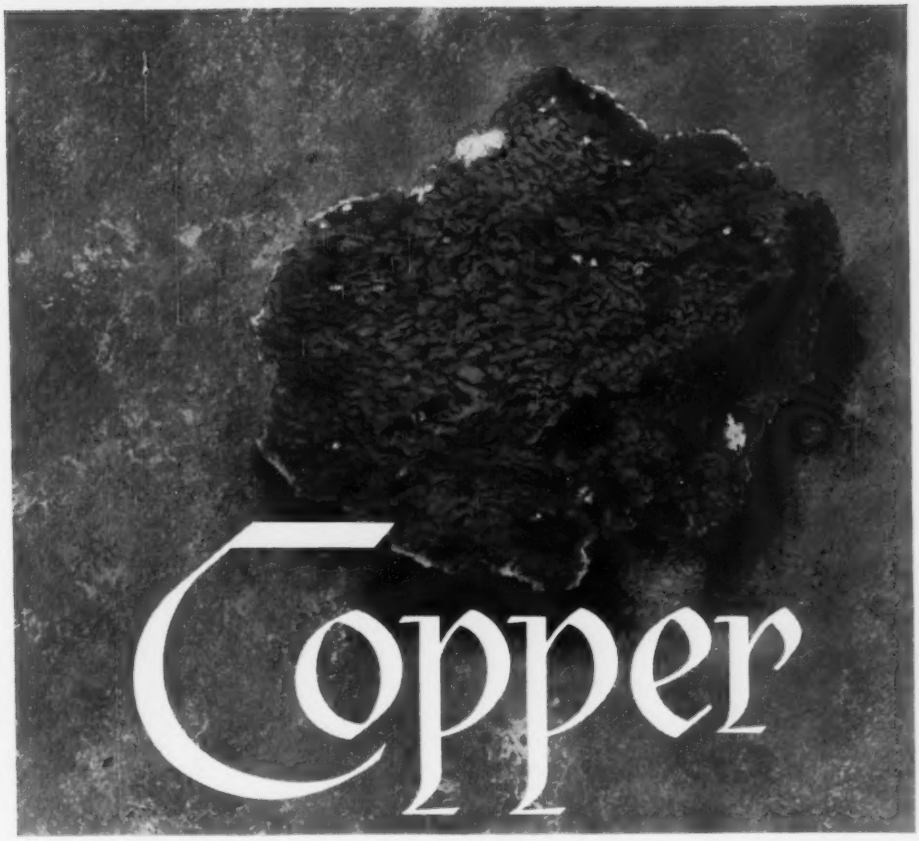
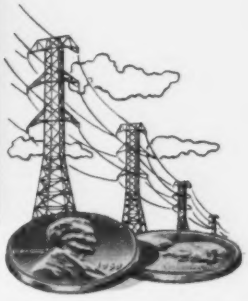


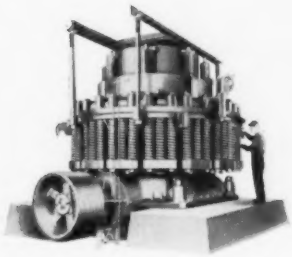


. . . symbol of money and power

The name *copper* is from the Greek κυπρος, Cyprus, one of the early sources of the metal. Copper has often been called "the common man's gold"—and has become a symbol of *money* due to its wide usage in the coins of many nations, as well as a symbol of *power*—since the greatest usage of copper has been as a conductor of electricity.

While native copper is the only metal found abundantly in nature, commercial production is supplied chiefly from various ores of copper, including chalcopyrite, chalcocite, cuprite and malachite.

Wherever these copper ores are processed—in Arizona, Chile, or the Belgian Congo—you'll find Symons Cone Crushers the leading choice among the world's prominent producers. For in copper . . . *as in all of the important ore and mineral operations around the world* . . . Symons Cone Crushers have consistently maintained their prominent position by efficiently processing large tonnages of finely crushed product at low cost.



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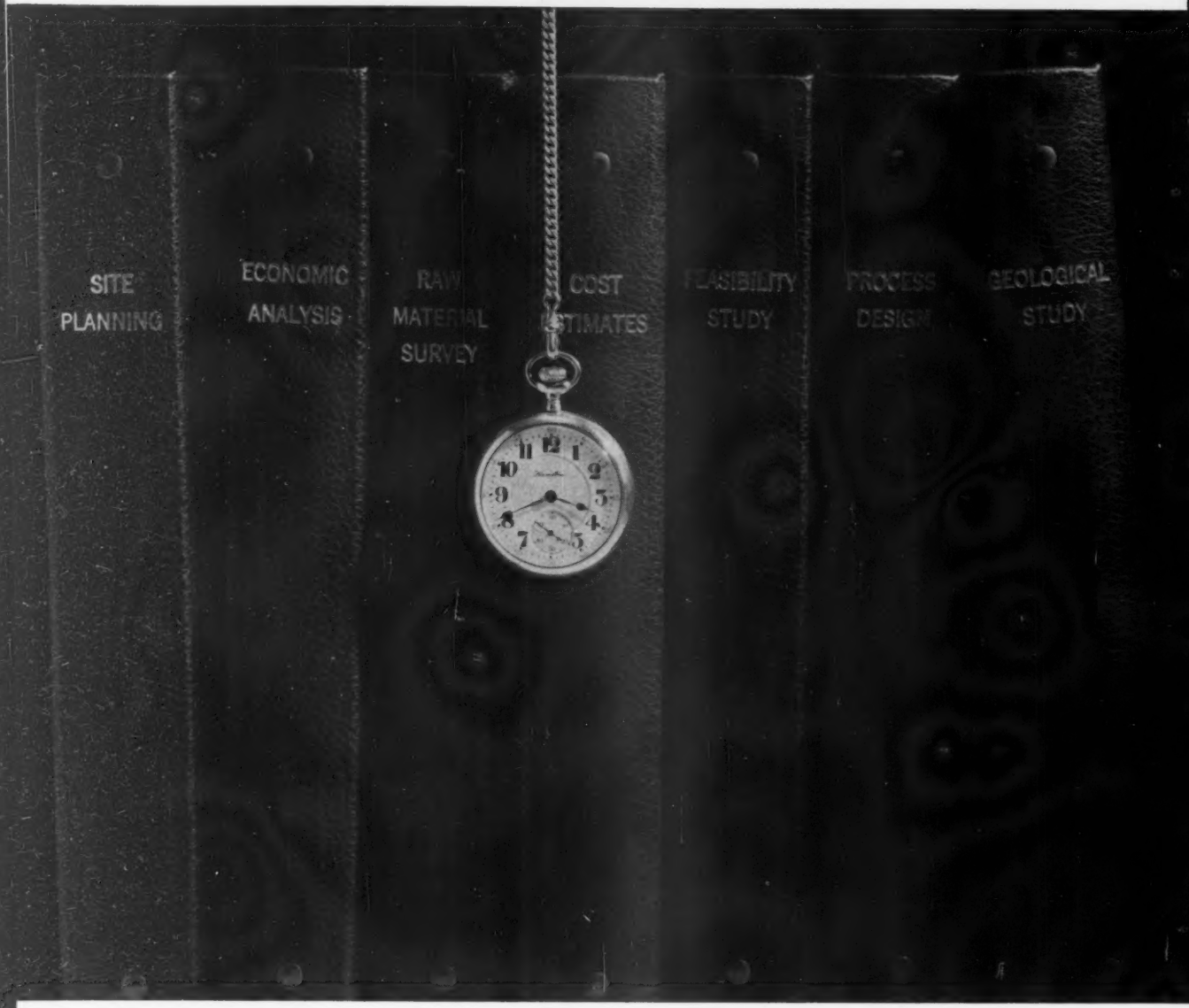
Pre-Engineering by **KAISER ENGINEERS** answers basic plant expansion questions...



Timely? Many complex factors shape the final decision to proceed with your expansion plans...and timing is an important one. Independent analysis of all aspects of your proposed program is the *Pre-Engineering* service offered by Kaiser Engineers. The studies and evaluations furnished by KE Pre-Engineering represent only one phase of total KE services. Kaiser Engineers is an experienced designer and builder of all types of facilities for the Minerals industry. From Pre-Engineering through design and construction, Kaiser Engineers provides complete, one-company service and ingenuity based on years of experience.

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6228-M

CONSTRUCTION of 38-mile rail line to $30-million potash plant is due.

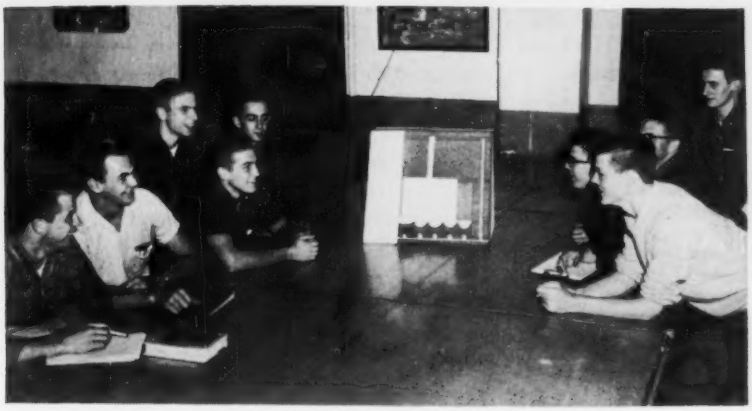
Texas Gulf Railway Hastens Potash Plant

WITH MAJOR ROADBLOCKS cleared for a 38-mile rail line to the huge Cane Creek potash reserve in southern Grand County, Utah, the $30-million project of Texas Gulf Sulphur Co. picks up momentum. Railroad construction will begin this summer at a cost of $5-6-million.

Stearns-Roger Manufacturing Co. is completing design and engineering on a surface plant, including mill which will have a beginning capacity of 10,000 tpd of ore. A 2200 ft concrete lined (divided) shaft on the north side of the Colorado River will tap the very high grade potash reserve which extends under the river.

Two trains daily, one going and the other coming, carrying between 70 and 100 cars of potash will leave the Cane Creek plant in the gorge of the Colorado. To maintain a proper 1% grade, a 1½-mile tunnel will have to be driven into the intersection of a rock promontory extending down to the Colorado river from Bartlett Mesa.

The TGS plant will rank among the largest producers of muriate of potash in the Western Hemisphere, with output to begin in late 1962.



Penn State Inaugurates Work-Study Plan

PENN STATE UNIVERSITY recently inaugurated a five-year work study plan in mining engineering with a freshman class of 25 who will alternate periods of attendance at Penn State with on-the-job experience in the mining industry.

The student-trainee program, in cooperation with 17 companies representing all segments of the mining industry is aimed at bringing career opportunities in the field to top-caliber young men. Most companies have selected a pair of students for whom a single job is provided. They alternate six month periods of work and study, one trainee of the pair attending Penn State while the other is on the job. The curriculum leads to a B.S. degree in mining engineering after five years rather than the usual four. In this time, however, they have obtained two years of practical experience while earning a college education.

Just mix and pour

NORDBAK

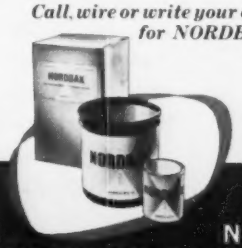
Tough, Resilient,

Non-Metallic

Here it is! NORDBAK . . . the manganese backing you pour at "room temperature." You simply mix the contents of two cans together and pour!

Field tests and on-the-job experience show that NORDBAK really works! Because it's resilient and non-shrinking, it provides excellent backing. It's so tough that in a prolonged test the manganese wore through in spots, but NORDBAK remained uncracked. It's easily removed at changeout, too. You can store NORDBAK at your operations . . . get a supply to keep on hand, ready for the next time you replace liners.

Call, wire or write your order for NORDBAK!



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N161-1/3

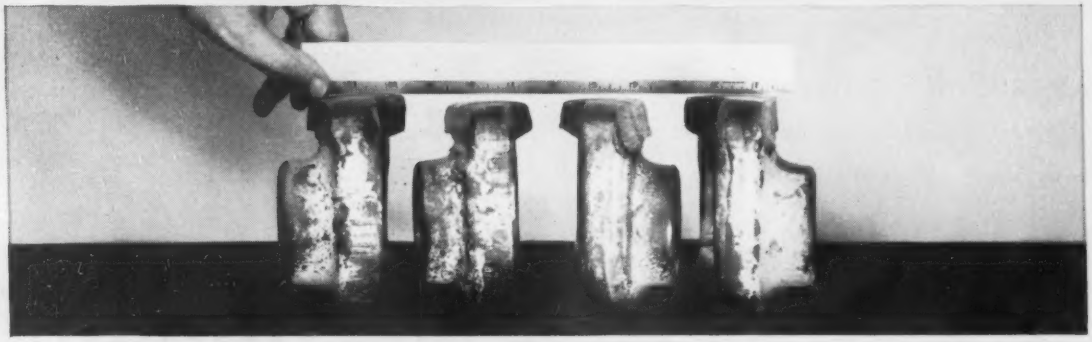
NORDBERG MANUFACTURING COMPANY
Milwaukee 1, Wisconsin

Special Report to Users of Caterpillar Equipment:

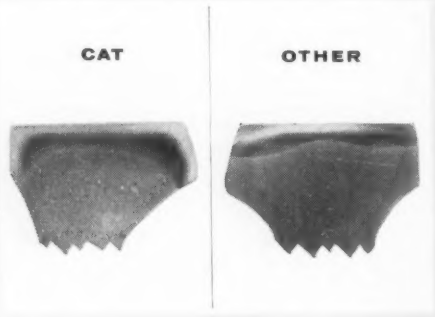
CAT CATERPILLAR

WHAT YOU DON'T SEE CAN HURT YOU

You can buy a lot of parts that *look* like genuine Caterpillar parts. Some may be cheaper initially. But they are as different as night and day when you get them in service.



Take these links, for example. They all *looked* identical when new. But see what has happened after 2000 hours on the same D8 Tractor! The two links in the center, a popular brand with induction-hardened rails, cost about 9% less than Caterpillar links originally, but showed about *50%* more wear.



The extra service you can expect from the Cat links can be seen and compared with other brands. Here are actual photos of etched cross sections of *production* links made by Caterpillar and the other manufacturer. The light areas at top show case depth and pattern of wear-resistant rail material resulting from heat treatment. See the deep, uniform wear case on top *and sides* of the Cat part? It's as hard as a good ball-peen hammer head. But in the other brand, the wear case varies both in depth and hardness . . . that's the reason why after 2000 hours on a D8 the Cat-made links had worn 50% less.

Investigate and you will find superiorities for every undercarriage component built by Caterpillar. This extra quality—though it sometimes costs a little more initially—pays off by delivering *extra* trouble-free working hours. That's why genuine Caterpillar parts cost you less per hour than other brands.

And when it's time to replace or rebuild your tractor undercarriage, see your Caterpillar Dealer. He is an undercarriage specialist with modern facilities to back him up. Get the full story on his many money-saving options and recommendations *tailored to your job conditions.* Truly CUSTOM TRACK SERVICE, designed to save you money . . . and offered only by your Caterpillar Dealer.

Caterpillar Tractor Co., General Offices, Peoria, Illinois, U. S. A.

CATERPILLAR

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B.C. Mining Officials Urge Concentrated Development of Natural Resources

A CALL for increased development of British Columbia's natural resources, coupled with encouragement that oversupply of some materials on world markets was a "short-term view" were the high points of the recent 49th annual meeting of the British Columbia and Yukon Chamber of Mines in Vancouver.

The speakers were Mines Minister Kenneth Kiernan, retiring president Dr. Christopher Riley and Thomas Elliott, manager of the Chamber. R. E. Legg consulting mining engineer has been elected to succeed Dr. Riley as president. Gavin Dirom and J. A. Gower were elected vice-presidents, with the following on the committee: William R. Bacon; D. M. Cannon; Frank Cooke; S. Fraser Crocker; H. A. Dennison; W. D. Elsdon; H. D. Gilleland R. H. Gram; F. J. Hemsworth; J. D. Little; Ralph C. Macdonald; T. J. McQuillan; G. R. McQuillan; G. R. McWilliams; G. A. Noel; J. S. Scott; R. H. Seraphim; Alexander Smith; H. V. Warren; L. G. White; J. A. Van Luvin.

Mr. Kiernan, in his address estimated gross value of B. C. mineral production last year in excess of $174-million. More than 11,000 mineral claims were staked last year, well above average for a 10-year period. Iron mining in B.C. has seen great development through the recent discovery of mine deposits along the coast, and discovery of additional iron ore deposits in this area is expected.

Dr. Riley, referring to gold losses by the U.S. Treasury assured that if the trend continues, B.C.'s gold industry can expect an increase in the price of this metal—greatly stimulating gold exploration across the whole of Canada. He feels that concern over world mineral surpluses is unwarranted and expects it won't be long before scarcities begin to appear.

R. E. LEGG, consulting mining engineer, was elected president of B. C. & Yukon Chamber of Mines

Mr. Elliott voiced concern about certain sections of "Canada Mining Regulations," recently introduced by Ottawa. While applying chiefly to Northwest Territories, they did "convey certain implications that could adversely affect mining exploration in other parts of Canada." Some clauses are "far too restrictive, while others were impractical."

B.C. laws, he stated, "now rank among the best in Canada," adding that the favorable legislation is "largely responsible for the current influx of prospectors and new companies from outside areas."

Diphenyl Slashes Costs In New Nuclear Reactor

MARQUARDT CORP., Los Angeles, has designed a small-sized commercial nuclear power generating plant which it claims would be competitive with conventional steam plants. The reactor—still very much in the conceptual and development stage—is designed for use in plants generating from 5000 to 20,000 kilowatts. The reactor will differ from other nuclear units in that it uses diphenyl ($C_{12}N_{10}$) instead of water for cooling, and can be used in areas where water is scarce. The reactor is designated DCDR (Direct Cycle Diphenyl Reactor). The properties of diphenyl are such that it can be used as a fuel as well as a coolant, thus reducing costs by enabling the use of a compact simple turbine of relatively few stages, not requiring vapor extraction, moisture separation or reheat stages.

Marquardt has applied to the AEC for funds to build an 11.5Kw prototype for the purpose of optimization study, for further studies into the parameters influencing design, and to seek further reductions in costs. Upon successful completion of the prototype, Marquardt could proceed with building its "first generation" commercial scale plant—to cost considerably less than the prototype after engineering had been worked out. It is hoped that after the first generation plant is built, second generation plants will be designed that will cut costs even further.

As for actual costs, conventional plants (operating at 20,000Kw) have a capital cost of 3.1 mills per kwh, with operating costs at 7.0 mills per kwh. The first generation DCDR plant (operating at 20,000 Kw) would cost 4.50 mills per kwh in capital charges with operating costs at 6.50 mills per kwh. Second generation DCDR units would cost 3.64 mills per kwh in capital charges and 5.7 mills per kwh in operating costs. Total capital investment for 20,000Kw conventional plants is $6.2-million, and for first generation DCDR plants, $9-million. Second generation DCDR plants will have a total capital outlay of $7.27-million.

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NORDBAK

It's Simple, Safe and Sure...

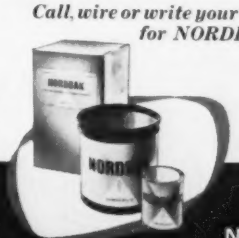
It had to happen... someone was bound to find a way to end the problems of backing maganese crusher parts with molten metal!

Now... you can do it with NORDBAK!

It's mixed at "room temperature" and poured right from a can into the crusher cavities. Gone is the need for special melting and pouring equipment...and gone are the hazards of pouring hot metal.

A trial order will prove, inexpensively, NORDBAK's many advantages.

Call, wire or write your order for NORDBAK!



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N261-1/3

NORDBERG MANUFACTURING COMPANY
Milwaukee 1, Wisconsin

IN THE U.S.

ALASKA

Bear Creek Mining Co., Kennecott subsidiary, has opened an exploration office in Anchorage. George A. Moerlein is in charge and will represent Bear Creek in all its Alaskan business except for the exploration at the Ruby Creek copper property. The company states that this is a step toward intensification of its work in Alaska. This is the first establishment of a year-around mining exploration office in Alaska since the War.

Little Squaw Mining Co. has purchased the tractors and other equipment of Hugh Matheson in the Chandalar District and will continue its development of the Mikado and Little Squaw gold lodes in the coming season. The second year of underground development and sampling brought very promising results.

ARIZONA

Daybreak Uranium, Inc., Spokane, Wash. has acquired a 40-acre gold placer claim near Oatman, the firm's secretary-treasurer, Kae Sowers, said. The claim is located across Silver creek from the Moss gold mine. It has been pooled with 15 other claims and is being developed by Harold Ferrin, of Sierra Diamond Drilling Co., Mesa. Ferrin will get 20% of the net profits from the operation. The feasibility of a low cost open pit mining operation has been indicated by drilling and a geophysical survey of the area, officials said.

CALIFORNIA

Preliminary tests for the eventual drilling through the earth's mantle will be continued this month at a site between Guadalupe Island and Baja California, under the auspices of the National Science Foundation and the American Miscellaneous Society Committee of the National Academy of Sciences.

The drilling ship, the Cuss I, will leave from either San Diego or Long Beach to begin drilling cores at 12,000 ft depth, preparatory to the attempt to enter the earth's mantle. According to scientists from Scripps Oceanographic Institute, La Jolla, first attempts will be for a drilling depth of 1500 ft. The mantle is believed to be some 15,000 ft from the surface.

Cuss I will be unanchored, holding to her position with large outboard motors placed at the four points of the floating drill platform.

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EXPLORATION FOR MINERAL DEPOSITS
INCLUDING URANIUM & LIMESTONE — ANYWHERE

FOUNDATION TEST BORING • GROUT HOLE DRILLING

Skilled crews and complete stock of core drills and accessory equipment maintained at all times

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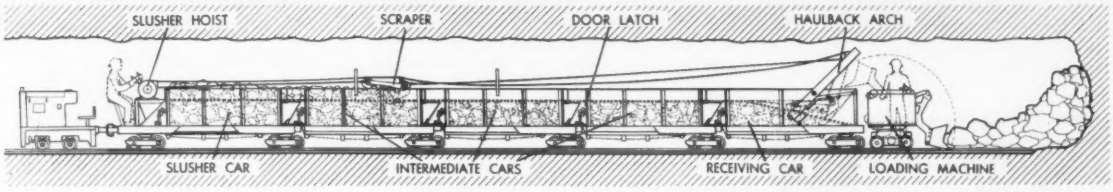
PUT THE COEUR D'ALENE *Trainloader* TO WORK FOR YOU

NEW SPEED-NEW SAFETY-NEW ECONOMY IN TUNNEL DRIVING!



less expensive — greater profits — and here's why:

The Coeur d'Alene Trainloader is not an experimental design, but a proven performing high-speed tunnel driving unit. Miners and Contractors alike have hailed its time-saving and cost-reducing performance. Here's how it works: After the blast, the Trainloader (consisting of a receiving car, a slusher car, and an optional number of intermediate cars) is pushed into the heading behind the mucking machine. The slusher operator connects into his power source and then tightlines the slusher hoist, automatically raising and locking the haulback arch into loading position. The mucking machine operator is now able to continuously load into the receiving car until the train is completely loaded, or until the heading is cleaned.

The slusher operator keeps the receiving car cleaned out by progressively filling each car to the slusher support bar level and then retreating as the cars become heaped. Two men handle the entire operation. No switching is required — no cars to couple or uncouple—offering tremendous savings in time as well as eliminating one of the most frequent causes of mine accidents. After tunnel driving is completed, the Trainloader may be used for production haulage. Its overlapping design allows continuous spillage-free loading from chutes or conveyors. Consider the savings in labor, time, and expense that a Trainloader will offer your operation and then write, phone or wire the Coeur d'Alenes Company, Wallace, Idaho, USA.

U. S. Patent No. 2,873,866. Canadian Patent No. 709,464. Foreign patents pending.

...THE COEUR D'ALENES COMPANY WALLACE, IDAHO, U.S.A.
SERVING THE MINING INDUSTRY FOR 77 YEARS

MANUFACTURERS OF MINE, MILL SMELTER AND LOGGING EQUIPMENT SINCE 1884

COLORADO

Standard Metals Corp., Moab, Utah, has encountered a new 16-ft vein of lead-silver-copper-gold ore at the end of its American tunnel in Colorado's Silverton district.

William R. McCormick, president of Standard, also announced that the drift had been finished to objective length, 300 ft below the water-filled ore-rich bottom of the Washington shaft:

The 16-ft vein is believed to be an extension of the Belcreo, an important producer in the old Sunnyside mine which Standard has leased from United States Smelting Refining & Mining Co.

DuPont Co. has engaged Stearns Roger Co. of Denver to do exploratory work on its deposit of pyrochlore near Powderhorn. The deposit contains columbium, tantalum and some rare metals.

An estimated 100,000 tons of ore exists in the deposit in Gunnison County on the Western Slope. DuPont acquired the orebody last year, and is reported interested in finding alloys for columbium and conducting other processing tests at its new metallurgical plant in Baltimore.

Three private firms bid a total of $1,152,756.60 for 1,139,900.44 lbs of surplus vanadium pentoxide offered for public sale by the Grand Junction Operations Office of the Atomic Energy Commission. The bids were opened on January 25 and the awards were announced today. Bids for an additional 360,250 pounds of vanadium offered at the same time were rejected and this material will be re-advertised for sale.

Union Carbide Metals, Vanadium Corp., and Derby & Co., Ltd., of Pittsburgh, Pennsylvania, were the successful bidders on the vanadium sold.

A 21-member committee including former U.S. Sen. Edwin C. Johnson (D), has been organized to push for enactment of a 27½% tax depletion allowance for shale oil. Bills proposing that allowance have been introduced in Congress by Sen. John A. Carroll (D) and Sen. Gordon Allott (R), both of Colorado.

Transmission lines which bring 800,000 gpm of warm water into the Leadville water system were placed in service Jan. 20.

The 50° water was piped from the old Canterbury Hill tunnel and is mixed with Leadville's normal supply of near-freezing creek water before going into residential consumer lines. The use of the warm water is planned to end the frozen and bursting pipes that plague the two-mile high city.

Leadville, famous silver mining camp, has a frost depth of 10 ft and the freezing water system has been a continual problem.

FLORIDA

International Minerals & Chemical Corp. has begun a $5-million expansion and improvement program at its Florida phosphate mines and plants. Floyd B. Bowen, general manager at Bartow, said the improvements would permit changes in mining plans to increase production. Included in the program is the purchase of a Bucyrus-Erie 1250 W dragline with a 35 yd bucket, to be installed at the Achan mine. The new dragline will be able to "walk" in seven-foot steps at one-sixth of a mile per hour, double the speed of current models. It will also have operators cabs on each side of the machine and operate with 2200 connected horsepower, 400 hp more than the "Super Scooper."

Another part of the program is the construction of a $1-million rock calcining plant at the Noralyn property. Upon completion, some 50% of the rock now dried and ground at the Prairie preparation plant at Mulberry will be switched to Noralyn, which will in turn have its wet rock storage and drying capacity doubled, its grinding capacity tripled, and dry rock screening added.

IDAHO

Bunker Hill has announced plans for extensive development work easterly and northerly of existing Bunker Hill workings to explore ground the company holds under operating agreements with the Yreka-United and Silver Bowl Mining companies. Two tunnels will be driven easterly toward the company's Crescent mine on Big Creek to develop known veins and eventually link the two properties, according to Joe Gordon, Bunker's manager of mines, and Roger McConnel, chief geologist.

Joseph T. Hall, president of the Callahan Mining Co., which owns the Galena mine west of Wallace, reports that exploration for the upward and downward extensions of a narrow but rich silver vein found in the property last year are well under way. The property is under operation by the American Smelting and Refining Co. on lease.

The shaft at the Conjecture mine near Lakeview, will be deepened from the 1000-ft level to the 2000-ft level, officials said. The mine, owned by Conjecture Mines, Inc., Spokane, is being developed by Federal Resources Corp., Salt Lake City, under a profit sharing agreement. Plans call for drifting through the Conjecture ore zone. Work at the silver property shaft project will start this spring.

Merger Mines Corp. of Kellogg has announced plans for extensive development and diamond drilling this spring in the long-idle Bear Top mine in the Murray district, 20 miles north of Wallace. E. C. Gerry, Coeur d'Alene, secretary of Merger, said the company has leased upper workings of the old property after acquiring deeds which have cleared up the title situation at the old property.

Sunshine Mining Co. is conducting a diamond drilling operation for the first time in St. Regis rock formation of the Sunshine Consolidated Inc., ground under operating agreement with Sunshine.

Just mix and pour

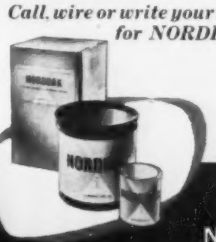
NORDBAK

It's the modern, effective way to back manganese

Non-metallic NORDBAK streamlines crushing operations of every kind. It's as easy to use out in the field as it is in the plant. You mix it and pour it right on the job...*wherever* your crusher is. No need for special melting or pouring equipment. Use it in gyratory crushers, cone crushers, grinding mills and other machinery where backing agents are required.

NORDBAK fills voids as narrow as ⅛" and is only ¼ the weight of other backing agents. Conveniently packaged, NORDBAK is *the one* modern, effective backing agent for manganese crusher parts!

Call, wire or write your order for NORDBAK!



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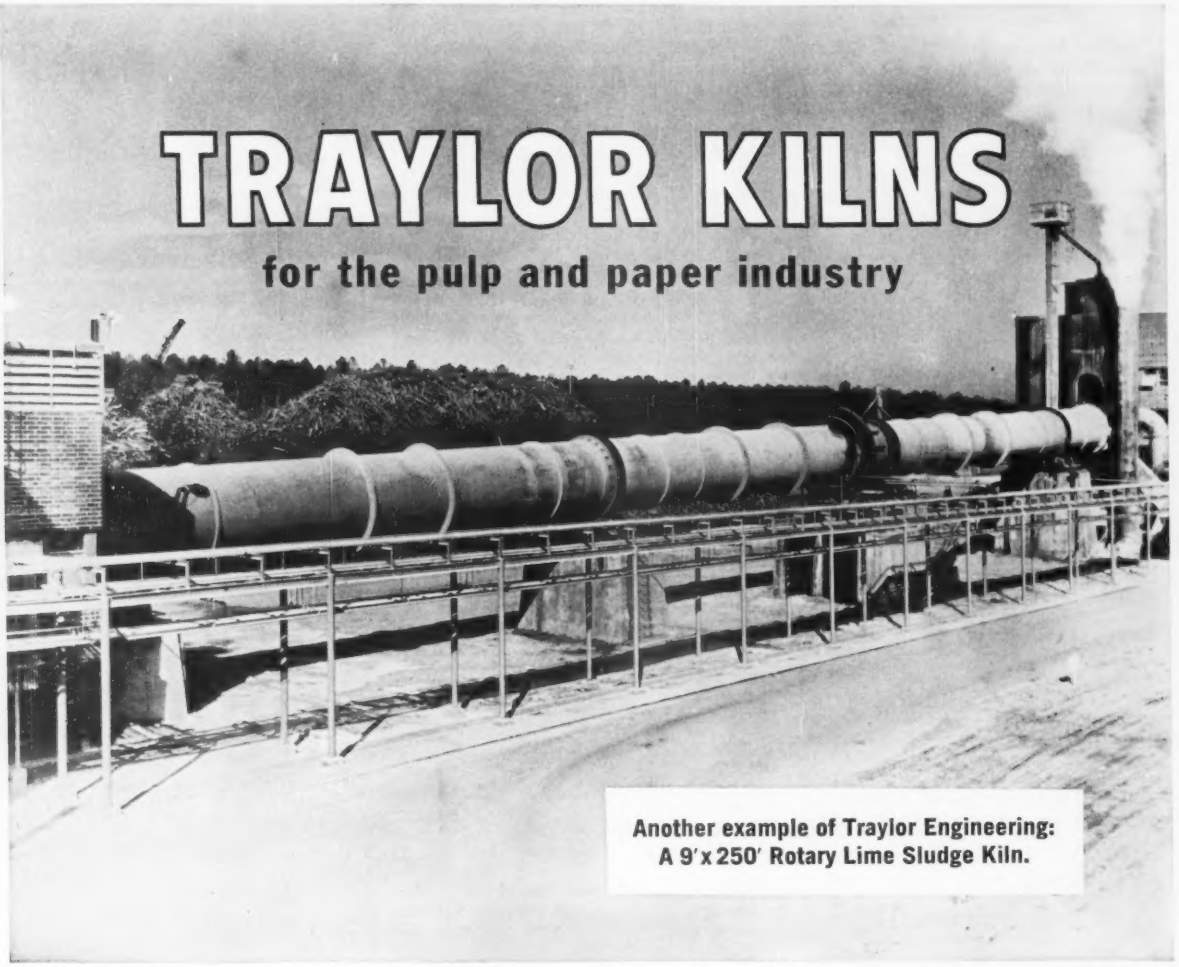
TRAYLOR KILNS

for the pulp and paper industry



Another example of Traylor Engineering:
A 9′ x 250′ Rotary Lime Sludge Kiln.

One of the most important advantages of Traylor Lime Sludge Kilns in pulp mill operations is their money-saving efficiency in recovering lime for reuse over and over again. This, plus Traylor's unexcelled heat recovery systems and thorough, experienced attention to engineering details, produces kiln installations that are notable for continuous service.

Write for Bulletin TKB-3 on Heat Recovery Systems, or Bulletin No. 1115 on Traylor Kiln installations.

See Chemical Engineering Catalog for details and specifications

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TKA-13

Just RIP TIP and POUR

You don't have to mix these new economy blasting agents

DU PONT NILITE® 101 AND 202

The minute you tear the corner off your first 50-lb. bag of "Nilite" 101 or higher-density "Nilite" 202, you'll enter a new era in blasting.

Now at last you have two low-priced, free-running blasting agents that give you Du Pont quality performance, shot after shot.

You don't mix "Nilite" on the job. You don't mix it at all. Just rip open the bag and pour it into any hole—small, medium, large—from 2″ diameter up. No clogging, no bridging in the hole.

No clouds of dust, and no ingredient to cause headaches. No messy oil-stained bags.

But easy loading is only part of the story of "Nilite." For full data on rock-breaking power, better propagation, greater safety and other advantages, send for our new fact sheet on "Nilite" or call your Du Pont distributor or representative. Start saving on your blasting . . . soon. Du Pont, Explosives Department, 6440 Nemours Building, Wilmington 98, Del.

Flows freely even in holes as small as . . .

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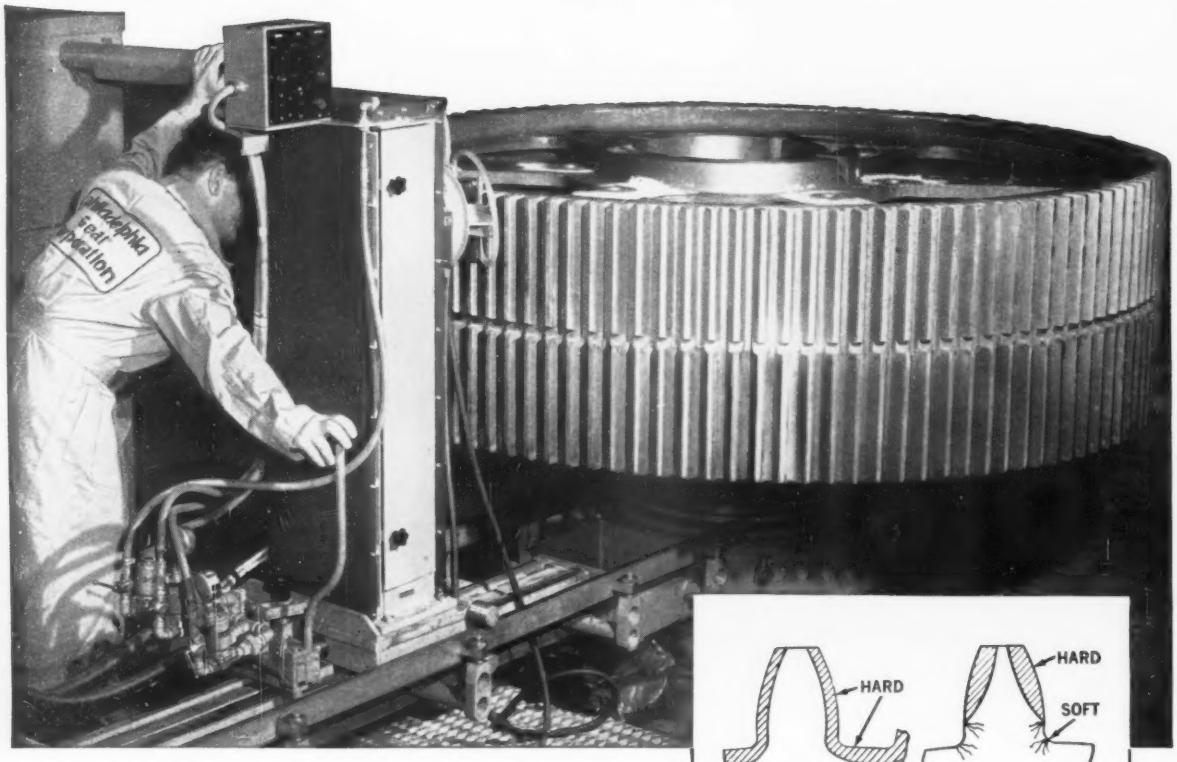
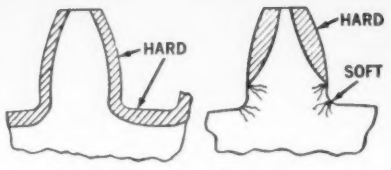
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

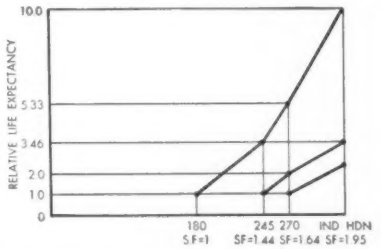
NILITE®

New Philadelphia induction hardening increases life of large gear drives . . .





New Philadelphia full contour induction hardening (left) provides a continuous hardened area from one tooth flank around the root and up the other flank without interruption. There are no points of stress. Typical heat treated gear (right) shows inadequate hardening of root of tooth, a point of major stress.



This chart shows the relationship between load and gear life. Note that the improved service factor of a gear set may be used to substantially increase gear life, rather than to increase the load.

HERE'S WHY: Full tooth contour induction hardening of large gears provides a uniformly hardened surface from one tooth flank around the root and up the other flank without interruption. Eliminates points of thermal stress concentration. And there is no distortion, a problem of heat treated gearing that requires subsequent grinding.

This new, advanced Philadelphia method permits radical reduction in sizing and/or increased load carrying capacities. And it can easily harden even the largest spur, helical and herringbone gearing up to 180 inches in diameter, 20 inches in face, and 3/4DP.

Learn more about this new method for increasing the service life of your gear drives. Write for your copy of Bulletin 100.

phillie gear® / **PHILADELPHIA GEAR CORPORATION**
King of Prussia (Suburban Philadelphia), Pennsylvania

ILLINOIS-KENTUCKY

The Ill.-Ky. fluorspar district shipped 73% of the 1960 total U. S. domestic shipment of 237,000 tons, according to preliminary figures. The two-state area shipped an estimated 173,000 tons which represents an increase of 42,500 tons over the district's 1959 total of 130,500 tons. Of the 1960 total, Illinois operators shipped an estimated 135,000 tons and Kentucky, 38,000 tons. The previous year's shipments showed Illinois: 112,500 tons; and Kentucky: 18,000 tons. Preliminary 1960 report of USBM shows total domestic shipments, including 141,000 tons of acid, 30,000 tons of ceramic, and 66,000 tons of metallurgical grade, valued at $10,616,000.

MICHIGAN

Cleveland-Cliffs Iron Co. has announced plans for the construction of a third jasper concentration plant to be located near Negaunee and completed by 1963. The new plant will have a capacity of 1-million tons per year. The property will be known as the Empire mine and will be an open pit. The company's other jasper plants are the Republic and the Humboldt, both of which have been enlarged since their original capacity. Both are owned with other companies, but operated by Cleveland-Cliffs Iron Co. When the new plant is operating, the three plants will have a combined capacity of about 3.5-million tons per year.

On Jan. 21 the 189 employes of Inland Steel Co.'s Morris mine at Ishpeming were notified that the mine, beginning in mid-February, would be gradually and permanently closed during the next five months. The announcement was made by Ray D. Satterley, general manager of ore mines for Inland. He said the company had tried for two years to upgrade the Morris ore, but it did not meet grade requirements of furnaces today. The mine is pumping 1700 gpm of water, bringing pumping costs to 70¢ per ton of ore produced on ore worth $8.25 a ton, or about 8½% of its value.

The Tobin mine of Republic Steel Corp. at Crystal Falls has again been closed although a crushing and screening plant recently had been installed in the shaft headframe at a cost of about $100,000. S. E. Howell, Duluth, manager of Republic's northern iron ore mines, met with representatives of Crystal Falls township, but could give no assurance as to the mine's reopening.

On Jan. 23, Pickands Mather & Co. laid off about 500 men at its five Gogebic range underground mines, as announced by E. L. Joppa, Duluth, gen. man. of P.M.'s Lake Superior area mines. The mines affected are: the Sunday Lake at Wakefield, the Peterson at Bessemer, the Newport and Geneva at Ironwood and the Cary, near Hurley, Wis. The 900 employes remaining after the lay-off are on 16 day-months.

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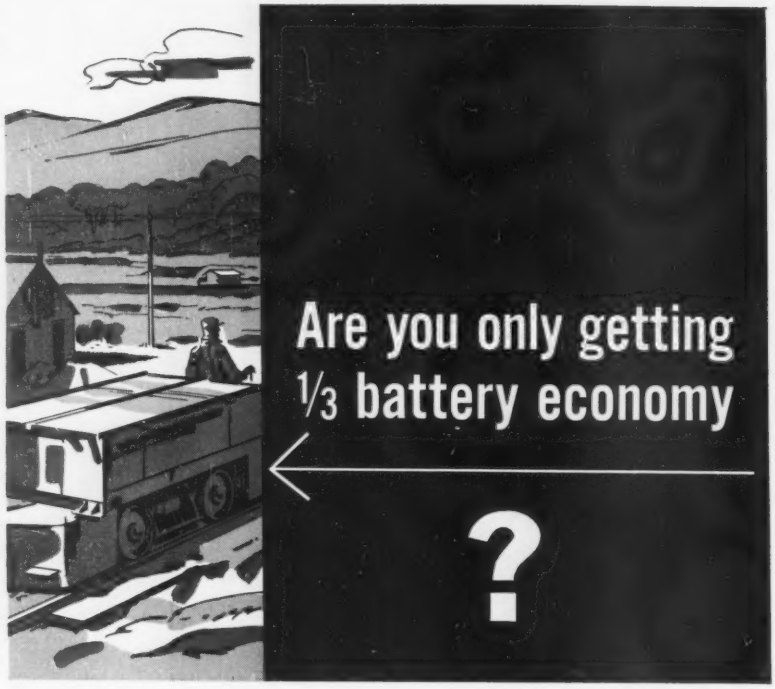

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MINNESOTA

The University of Minnesota School of Mines & Metallurgy Symposium was held Jan. 10-11. The predominating subject of the session was "Factors Affecting the Future of Lake Superior Iron Ore." First speaker Tuesday morning was Prof. Eugene P. Pfleider, head of the School of Mines & Metallurgy. He discussed the "Role of Education in the Competitive Position of the Lake Superior Iron Ore Industry." He deplored the serious lack of top students who enter the mining industry, and urged work-study programs to assist in financing while learning, and an increased interest in the school programs by the mining industry.

Herbert C. Jackson, Cleveland, vice-president, Pickands Mather & Co., talked on "Influence of Taxes on New Iron Ore Investments in Minnesota", a subject which has received much attention in recent months. "Varying Impact of Labor Costs" was the subject of William Montague, Duluth attorney, with emphasis on the accumulating fringe benefits. Hugh J. Leach, Ishpeming, Mich., vice-president, foreign operations and ore development, Cleveland-Cliffs Iron Co., gave a paper on "Relationships of Labor Productivity & Costs." The slides showed the tons-per-man-day; labor cost per man-hour, and cost of production at Michigan underground mines and Minnesota open pits. Tuesday afternoon was taken up with "Transportation, Handling & Storage of Iron Ore." A paper by Fred Vines, Cleveland, chief engineer for the M. A. Hanna Co., and read by J. W. Buford, Cleveland, assistant vice-president of the company, noted the increasing cost of lake ore transportation and advocated larger ore carriers, which would require improvements in docks and ports and deepening of channels. John S. Wilbur, Cleveland, vice-president, ore sales of Cleveland-Cliffs Iron Co., said that transportation of iron ore constitutes 6% to 10% of the cost of finished steel. The higher iron content of Lake Superior pellets and high grade foreign ores, therefore, makes them highly competitive. Foreign ores can be taken to our east coast in much larger ocean ore ships.

On Wednesday, Jan. 11, Hugh M. Roberts, Duluth, consulting geologist, gave a paper on "Lake Superior Iron Ore and American Population Growth." He cited the favorable location of the area in relation to the center of population, and also brought out that, on the Mesabi range, much of the capital requirements have already been made and amortized. He stated that there is an abundance of mineral material on the range from which merchantable furnace supply could be provided at the rate of 60-million tpy for the next 100 years. Robert E. Powers, Pittsburgh, sales manager for the Koppers Co., said that nearly all pelletizing plants are at the mines, and most sintering plants are at the furnaces. "An agglomerating plant at the mine or at an intermediate point has the advantage of ample storage area." The concluding and summarizing talk was made by the dean of the general extension division of the University, Julius M. Nolte. Although optimistic as to the future of the Lake

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BEST BUYS IN NEW AND USED EQUIPMENT

Minnesota (*Continued*)

Superior iron ore area, he predicted no change in the trend toward greater competition.

M. A. Hanna Co. announced Jan. 10 that it would return about 675 men to work at its Mesabi range mines on Jan. 17.

Effective Jan. 30, the Oliver Iron Mining Division laid off 475 of its Mesabi range employes. Two hundred were in the Virginia-Eveleth district and 275 in the Hibbing, Chisholm-Coleraine area. It was explained that Oliver was compelled to reduce its work force because of large stock-piles of iron ore at lower lake furnaces and of increasing competition from higher grade ore from outside of Minnesota. Much of the ore remaining in the state does not meet the strict requirements of the steel industry.

Rhude & Fryberger produced 404,941 tons in 1960 from three Mesabi range mines and one, the Pennington, on the Cuyuna range which R.&F. has operated since 1945. The Pearsall, near Eveleth, was first with 152,647 tons. The Boeing and Alworth at Hibbing shipped 122,945 tons and 117,660 tons respectively, the Pennington 164,336 tons.

The Oliver Iron Mining Division shipped a total of 23,500,164 tons in 1960 compared to 15,067,516 tons in 1959. For the last 10 years only two years—1958 and 1959—have been less than the 1960 shipments. The 1959 tonnage was the lowest during that period. As for some years, all of Oliver's production came from the Mesabi and Vermillion Ranges of Minnesota. No. 1 producer was the Rouchleau group at Virginia, 5,893,824.

NEVADA

Reorganization of Combined Metals Reduction Co. for purposes of exploiting metallurgical advances in treatment of Pioche District lead-silver-zinc-manganese ores, has been approved by principals in the firm.

R. J. Dalton & Sons have completed a $250,000 treatment plant near Pioche to treat tailings from the Combined Metals Reduction Co. mill. On Feb. 1 they began shipping material from the new plant, and output is expected to average 400 tons monthly. The product will be used as fertilizer and ground conditioner. Employment at the plant is expected to reach 20 men when operations get underway.

Will Austin, Whit De La Mare and Charles Rowe are shipping iron ore from their recently developed property at Barth, near the Humboldt river and Southern Pacific tracks in Elko County. Preliminary work included diversion of the river channel to permit mining operations, and removal of overburden from an estimated 80,000 tons of ore. The three men have signed a contract with Japanese interests and are now shipping 500 tpd to the Orient via the port of Stockton. Ore from Barth is mixed with high grade iron ore which the three men are mining in the Jackson mountains of

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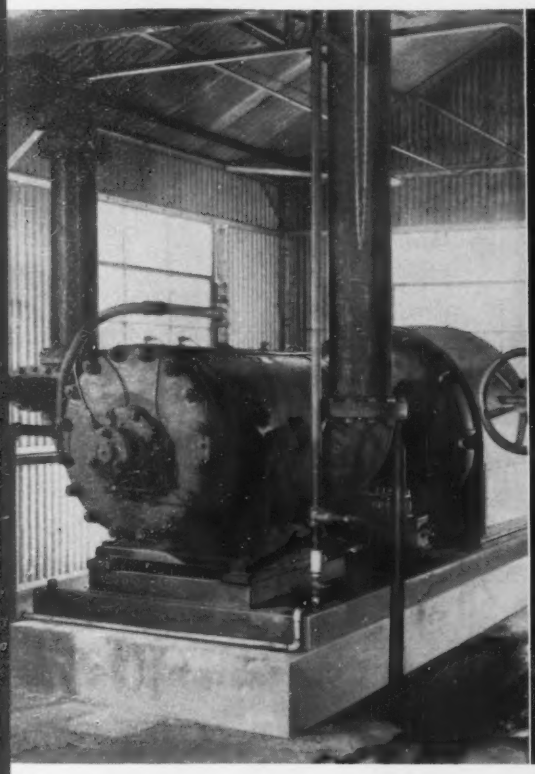

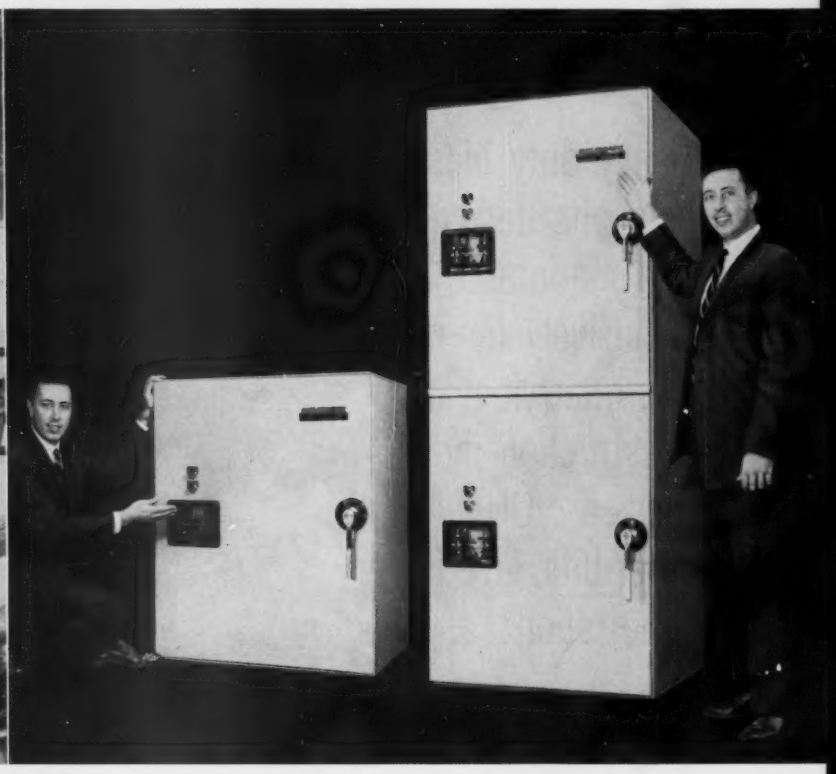

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So low, two fit where one used to go: This new SpaceMaker control center is the first completely new 2- to 5-kv motor controller development in more than a decade. New compact two-high design can cut floor space requirements in half. Complete drawout construction makes it the safest, most easily accessible controller on the market. New flame-retardent, track-resistant Super Pyro-Shield insulation adds to reliability, reduces size and weight. And, the all-new roll-out contactor has been designed specifically to cut maintenance time and costs.

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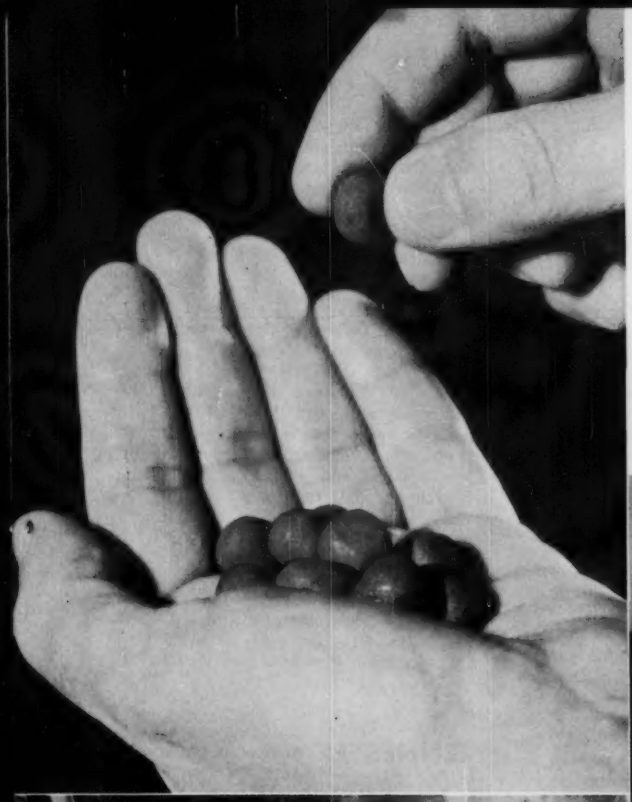
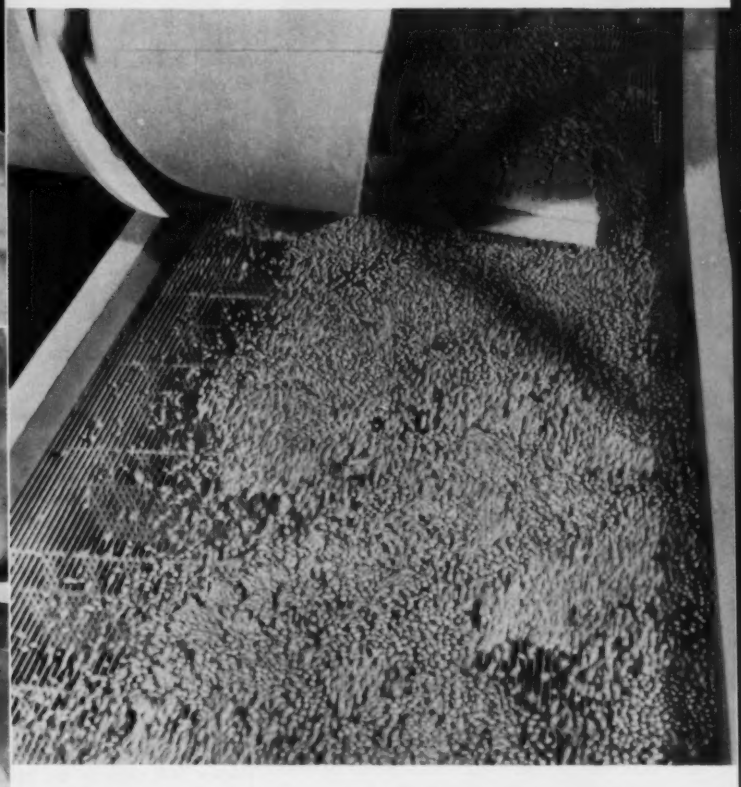
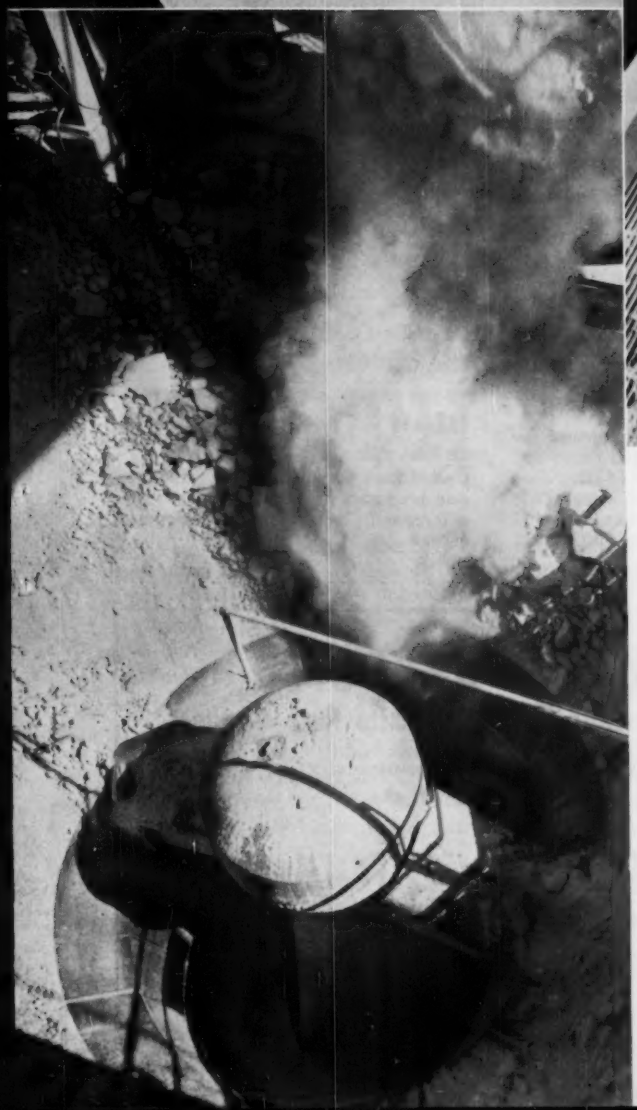


From low-grade ore . . . ideal blast furnace feed: Now processing 1000 ltpd of beneficiated, finely powdered concentrates from low-grade iron ore, the new Grate-Kiln system produces these iron-rich pellets. Easy to ship and ready to use as blast furnace charge, these pellets are also economically produced. Costs are kept low by a unique system of heat recovery and process control.

Keeping pellets optimum sized: Installed as part of the first Grate-Kiln system used for iron ore processing, this specially-designed A-C vibrating screen "sizes" pellets from the Allis-Chalmers balling drum, permits only properly sized balls to pass to the system for heat processing. Years of experience in handling screening problems like this have resulted in a wide range of screen sizes and features.





Rugged primary gyratory crusher: This 60-inch Superior gyratory crusher crushes tons of hard, abrasive ores daily — proof of its tough construction. But, in addition, this machine requires no downtime for resetting to compensate for mantle and concave wear. The Hydroset control, exclusive with A-C cone and gyratory crushers, permits instantaneous wear — compensating adjustment while in operation.

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Nevada (*Continued*)

Humboldt County. This reduces the percentage of phosphorus per ton in the over-all shipments.

White Caps Gold Mining Co. has discovered a new, large orebody with values ranging from 0.83 to 7.07 oz of gold per ton in the White Caps mine at Manhattan in Nye County. The ore, which averages 2 oz gold per ton was located by diamond drill exploration from the 1200-ft level of the mine. Hugh Cameron, superintendent in charge of the operation, said that present plans call for surface drilling on the company's April Fool claim which lies 200 yards northwest of White Caps.

Mines Contracting, Inc. has completed its contract to deepen the shaft and drive 350 ft of drift and crosscut for Gold Eagle Mining Co. at Lone Mountain. W. T. Benson, of USBM, made the final inspection of the work Jan. 20. An OME loan helped finance the exploration work. **U.S. Milling and Minerals Corp. which has been operating the Ohio mine at Gold Point, is now reopening the Western shaft** in the same area. A 187 kva Caterpillar diesel generator has been installed to operate the double drum hoist, and three shifts are at work on the main shaft, getting it ready for production. The Western was a large producer of silver ore during the early 1900's. Three months of development work is planned before actual production of ore is started.

American Exploration & Mining Co. has returned to Goldfield to do additional exploration work on Gold Consolidated ground. The new work consists of an incline shaft to be sunk a distance of 220 ft. Whitney C. Hansen, Salt Lake City mining contractor, and a crew of two men are now down 75 ft and making good progress. All muck is being removed from the excavation by a small slusher. Hatfield Goudey is in charge for American Exploration & Mining Co.

Silver Ace Mining Co. has reopened the Burner Hill mine in the Midas area and is producing a good output of silver-lead ore. Five men are working under Dale R. Gillam, mine superintendent, and have blocked out an orebody 300 ft long, 50 ft deep and from 2- to 3 ft wide. Work has been started on a mill at the site. Silver Ace took over the property on a five-year lease with option to buy.

OREGON

Lakeview Mining Co., owner of a 210-ptd mill at Lakeview, proposes shipment of ore from the Shirley Basin area of Wyoming to that mill.

This could be one of longest uranium ore hauls on record.

Lakeview has filed for rates for the shipment of ore from Medicine Bow, Wyo. via Union Pacific Railroad and Southern Pacific to Lakeview.

The firm's concentrator at Lakeview has been shut down since last fall because of a lack of ore. Lakeview has contract with AEC running into 1963.

Lakeview is sister firm to Gunnison Mining Co., operator of a mill at Gunnison, Colo. Both firms are controlled by the Richards-Bass-Murchison interests of Dallas-Fort Worth.

TENNESSEE

American Zinc Co. of Tennessee has drastically cut production of zinc concentrates at their mines in the East Tennessee zinc district. On Jan. 31, the Grasselli mine at New Market was completely shut down. It had been operated on a development basis for the past six months. The Coy Mine at Jefferson City was taken out of production and put on a development basis on the same date. Production at the Young mine is being reduced approximately 15%.

William Black, manager of American Zinc announced that this reduced rate of production will continue until the market for zinc oxide and zinc metals improves.

UTAH

United Park City Mines Co., lead-silver-zinc producer, has placed employees on a three-shift basis to spur development of new ore.

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Working on the Cross Westchester Expressway in New York State, Mount Vernon Contracting Corp. put Amsco Simplex Teeth on its four shovels and two backhoes. Teeth previously used required daily welding build-up to maintain points. Since switching to Amsco Simplex, teeth are changed only about once a week. And change-over is only a 5-minute job.

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So much for tests. Now we have reports from hundreds of customers, telling us that Amsco Simplex is the longest-wearing tooth they ever had.

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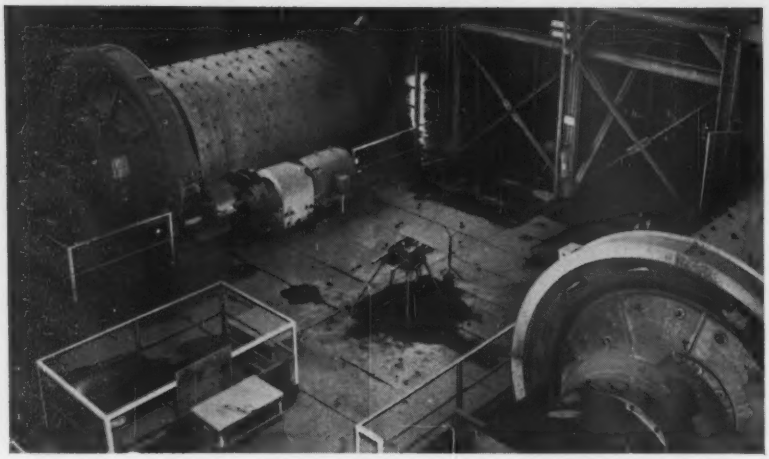

Marcy Scrubbers

PROVED PERFORMANCE *on the* MESABI IRON RANGE

A prominent mining company in Minnesota is using two 9½'x19½' Marcy Heavy Duty Scrubbers in one of its concentrators, on a tough iron ore cleaning problem. This installation followed use of Marcy Scrubbers in two of the company's other concentrators.

Proved Advantages of Marcy Scrubbers

- The Marcy principle of small diameter, long length scrubbers gives...
  longer time of positive, active scrubbing,
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  which results in more *effective* scrubbing with less horsepower.
- Heavy duty construction, operation on trunnion bearings, and properly designed drives, combine to eliminate vibration.
- With trunnion bearing design there is no maintenance problem due to corrosion and abrasion.

TYPICAL LOCAL SERVICE
This Minnesota installation was engineered and serviced through the cooperation of the mining company, Mine and Smelter, and its agent, Continental Sales and Equipment Co., Hibbing.

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Utah (*Continued*)

The action was taken in order to avoid laying off some 50 miners, said S. K. Droubay, vice president and general manager.

"We are trying to go on a three-shift basis to develop the 1900-foot level and the 2000-ft level, as well as extend a new winze from the 2000 to the 2100-ft level. This will save laying off 40 to 50 men because of the declining ore reserve on and above the 1700 ft level," Mr. Droubay said.

No increase in production will result from the new shift operations, he said.

In reducing its domestic mine production by some 12%, effective Feb. 1, 1961, Kennecott Copper Corp., will follow this schedule:

Lay off a total of 1,295 day pay production workers.

Cut output from 34,000 tpm by 4500 tons, to 29,500 tons a month.

Lay-offs will affect an estimated 631 workers at Utah Copper division; 195 at Nevada Mines division; 191 at Ray (Ariz. and 278 at Chino (N.M.).

Utah Copper tonnage would drop by 2840 tons to 17,160 tons monthly; Nevada, by 520 tons to 3380 tons a month; Chino, by 530 tons to 4670 tons and Ray by 610 tons to 4190 tpm.

American Exploration and Mining Co., San Francisco, has joined Armet Co. and Chief Consolidated Mining Co. in development of the old Holt silver mine six miles north of Enterprise, Iron County.

Samuel S. Arentz, Salt Lake City, president of Armet Co., is serving as operator on the venture.

Chief Consolidated and Armet in the past three years have carried out extensive diamond drill work at the property and several hundred thousand tons of ore with an approximate grade of 30 oz of silver and minor amounts of lead indicated.

American Exploration is a subsidiary of Placers Development Co., Vancouver, B.C.

Presently, the joint venture is sinking a 24-in. rotary hole to unwater a section of the mine in preparation for shaft work. A 600-ft shaft will be required to bring the mine into production, Arentz said.

Union Carbide Nuclear Co. announced closure of its Green River uranium ore up-grading plant on Feb. 25.

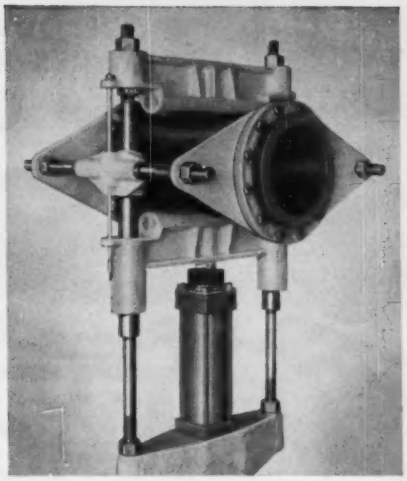
The plant, employing 34, began operations in January 1958.

J. L. Lake, manager of UCN's Colorado Plateau operations, said the company's ore, and that from independent producers in the eastern Utah region, will be shipped to Rifle and then to the company's plant at Uravan.

VIRGINIA

Industrial development of iron ore deposits in Jefferson National Park (Giles & Bland counties) is at least two years away, the Giles County Chamber of Commerce was told.

AUTOMATED *Hydral-60* PINCH VALVE SYSTEMS



Controlled circuitry for any operating requirements

- The Massco-Grigsby Hydral-60 System consists of one or more pinch valves with a single automatically operated hydraulic pump.
- Hydraulic pump may be operated by electric motor or by air from normal plant supply system.
- Valves may be the same or different size.
- Valves in the system may be operated simultaneously or independently.
- Control valve may be manual or solenoid.
- Valves are self-supporting and may be operated in any position from horizontal to vertical.
- Valves may be coordinated and interlocked with other plant equipment to automatically control tank levels, rate of flow, etc.
- Valves may be independently controlled for normal or rapid closure.
- Valves may be held fully open, fully closed, or at intermediate positions.
- Remote control to meet individual requirements.
- Controls may be included for automatic emergency operation.
- 3" to 14" I.D. sizes, with 50, 100, and 150 psi line pressure ratings.
- Temperatures to 200° F.

Advantages of Massco-Grigsby Pinch Valves

- Rubber, neoprene and special compounded rubber sleeves for corrosive and abrasive pulps and liquids.
- Patented "hinged" sleeve. Recesses serve as "hinges" during compression; reduce strain and permit tight closing.

- Unobstructed flow eliminates high friction loss and prevents contamination.

- Split flanges and patented Flex Seal ends assure perfect seal.
- Rugged, heavy duty construction for most severe service and long life.
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- No working parts in contact with pulp or liquid; no packing glands.

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WASHINGTON

Day Mines, Inc., Wallace, Idaho, said that new gold-silver ore has been disclosed near Republic, which is being developed jointly by Day Mines and Knob Hill Mines, Repubulic.

The company also said diamond drilling has indicated a continuance of a vein at the Gold Dollar operation in the Republic area.

A report on the fourth quarter of 1960 said the firm milled 12,572 tons of ore compared with 20,202 tons for the same period of the previous year.

Day Mines reported that promising mineralization has been indicated on the 2800-level at the Galena mine and that crosscutting work on the 3700-level is progressing.

Production tests were being conducted during February at the tungsten mill being constructed five miles south of Spokane at the old Silver Hill tin mine. Carl A. Coon, Spokane, owner of the mining property, said a 150 tpd gravity-type plant is nearing completion.

Idaho Mining and Milling Co., Lewiston, Idaho, has purchased a third dredge for gold mining in the Florence basin area of Idaho County. The 300-ton bucket unit will be moved to the site from the Ruby Meadows area, about 75 miles south. A 250-ton unit already is at the site and another unit purchased earlier is being kept near Elk City, Idaho. Officials said operations are expected to start about July 1.

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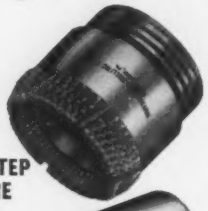

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J-3-61

WISCONSIN

A water transportation system across Wisconsin, from the Mississippi River to Green Bay via the Wisconsin and Fox Rivers, could revive the lead and zinc mining industry in Southeastern Wisconsin, in the opinion of Harold Geisse, of the State Department of Resource Development.

Development work is progressing on three new mines in the Southwestern Wisconsin zinc mining area.

Piquette Milling and Mining Co. had crews working around the clock sinking an incline shaft near Tennyson, with full production expected sometime in February. The flotation machinery was ready for operation at another Piquette mine less than a mile away, where production was halted last year to permit development work to get started on the new mine.

New Jersey Zinc Co. is developing two new mines near Elmo. A flotation mill was to be started as soon as the frost left the ground, and mine production was scheduled for 1962, to coincide with the completion of the mill.

A three-man zinc mining operation, about six miles southeast of Platteville was almost ready to produce ore in early February after development of a shallow incline mine.

Joe Grimes, the mine operator, and Clarence Richter and George Hillery, his coworkers, have been working about a year to reach the ore vein and shore up the incline shaft.

"We'll take out about 50 tpd of ore," Grimes said. "The way we mine it probably will be 50 years before the vein runs out."

WYOMING

Titanium Corp. of Wyoming has announced plans to construct an iron ore processing plant at Farthing, about 26 miles north of Laramie.

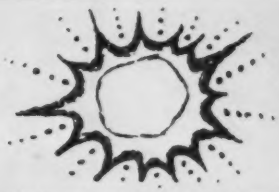
Ade Walker, agent for the company, said between 12 and 15 men would be employed at the fully-automated plant to process the ore at the firm's deposits on Iron Mountain. Walker said the plant would use a water-wash system to produce eight different sizes of ore pellets.

IN CANADA

ONTARIO

Campbell Red Lake Mines finished off 1960 with new records in production and grade of ore treated at its gold producing mine in the Red Lake area. Bullion output was valued at $5,597,049, up from $5,466,814 for the previous year. Average recovery moved ahead from $21.29 to $21.70 per ton. Tonnage milled was 162,666 tons against 162,276. Development work is still confined to known ore zones above the 14th, or 2050-ft level, while the shaft now ex-

The Getman Brothers' KD-5A Scoot-Crete uses an air-cooled Deutz Diesel.



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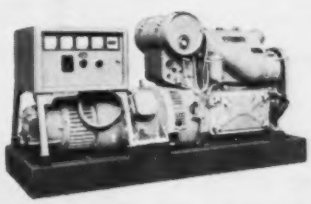
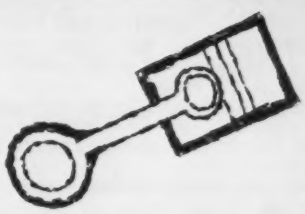


Deutz air-cooled Diesels are also used on generators, compressors, stand-by power equipment.



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A4L 514	72	2000
A6L 514	110	2000
A6L 614	110	2000
A8L 614	145	2000
A12L 614	220	2000
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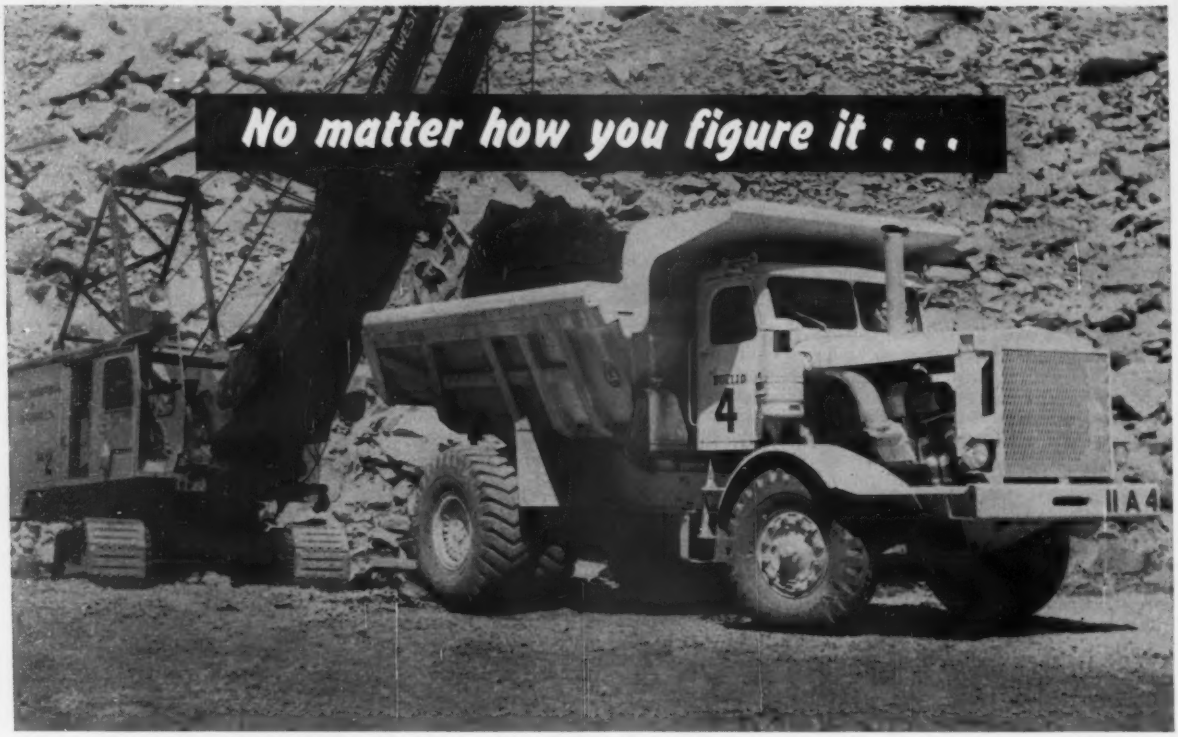

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Ontario (*Continued*)

tends to a depth of 3180 ft, leaving seven levels yet to be developed.

Caland Ore Co., Ltd., Steep Rock, Ontario, (Inland Steel Co.) has sunk a shaft to develop the Falls Bay underground ore. It is expected to be hoisting ore by 1963. 1960 shipments came from the Lime Point pit. By 1969 Caland's shipments are scheduled to reach 3-million tons annually.

Another record breaking year was scored by Cochenour Willans Gold Mines in 1960. Production reached an all-time high of $2.5-million and grade was maintained at well above the $25 per ton mark. In the meantime, good progress is being made in the expansion program with promising results being obtained both at the mine and at the adjoining Wilmar Mines' property.

Copper concentrate production started at the Rio Algom Mines' Pronto plant near Spragge, Elliot Lake, in mid-January. Initial rate is 500 tpd, which is to be increased to 600 tons in the near future, and to 750 tons later this year. Mill feed is being drawn from the Pater copper property, some two miles from the mill. The mill was previously used to treat ore from the Pronto uranium property.

Urwick, Currie Ltd., Toronto, management consultants, will conduct a new two-week course called "Management and Productivity for the Mining Industry" as a new approach to increase productivity and improve efficiency at mining operations.

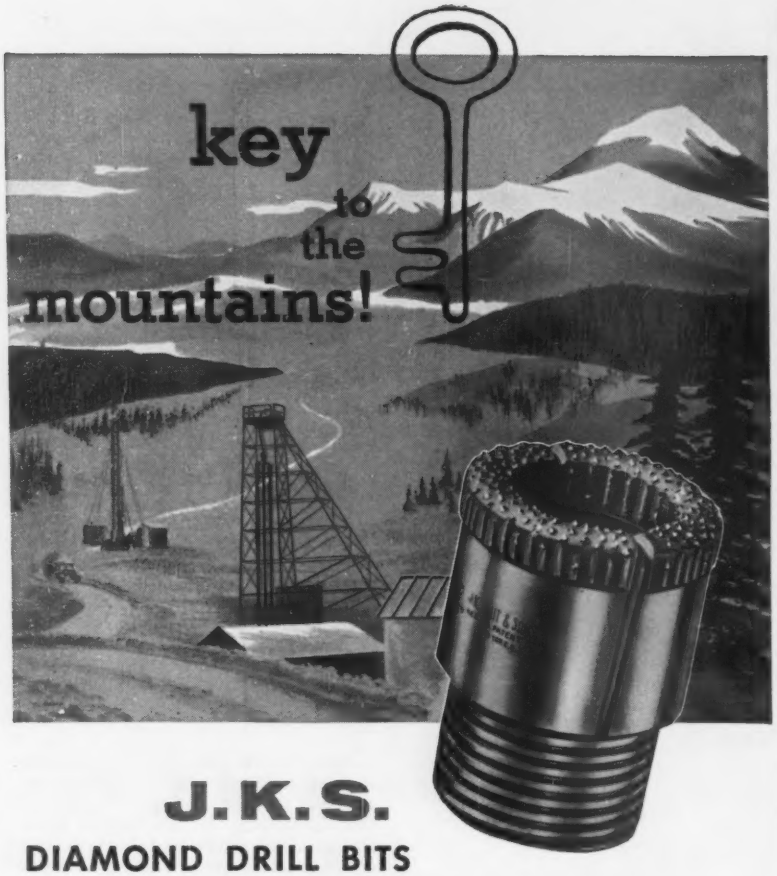
QUEBEC

Sturgeon River Mines has acquired purchase option on the Bachelor Lake area gold property of O'Brien Lake Gold Mines. Drilling by the latter company indicated 373,900 tons down to 1000 ft with grade of 0.33 oz gold ($11.55 per ton at $35 per oz). A drilling program has been arranged to fill in some sections within the main oreshoot and to extend exploration along strike and to depth. The present tonnage could be handled at the nearby parent company (Coniagas Mines) mill.

Preliminary design of a 200-tpd pilot mill has been started by Columbium Mining Products for its columbium property in the Oka district. The decision follows encouraging results obtained in bulk sampling of ore. The company, owned jointly by Headway Red Lake Gold Mines and Coulee Lead and Zinc Mines, plans to get into production as soon as possible. At peak rates it is calculated that some 750,000 lb of columbium pentoxide would be turned out annually.

NEWFOUNDLAND

Newfoundland Fluorspar, wholly-owned subsidiary of the Aluminum Company of Canada, expects to boost fluorspar ship-



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Newfoundland *(Continued)*

ments from its St. Lawrence mining operations by about 15% during the current year. In 1960 shipments totalled 65,689 tons and target for 1961 is around 75,000 tons. All shipments go to the parent operations at Arvida, Que. Consideration is now being given to deepening the shaft to open two more levels down to the 950-ft horizon in the No. 2 shaft.

Atlantic Coast Copper Mines has advanced scheduled production at its Little Bay copper property from mid-March to mid-April. The change does not reflect any delay in the construction program, which is on target. The work at the property is under the direction of O'Brien Gold Mines, which holds a 42% interest in Atlantic.

The Flintkote Co., New York, has completed arrangements with the Province of Newfoundland for 99-year renewable rights to vast high quality gypsum reserves.

Flintkote will ready these facilities so that the company can plan on shipping gypsum rock "this summer."

NOVA SCOTIA

New interest has been stirred in the gold possibilities of the province. Several large companies are reported to have taken up ground in preparation for full-scale investigation of numerous gold occurrences. The province's first gold discovery was made back in 1860 but efforts then were sporadic and techniques were primitive. New geophysical and geochemical methods will permit a more thorough examination of the known mineral occurrences, some of which have never been explored. Companies reported to be holding ground include Consolidated Mining and Smelting, Kerr-Addison Gold Mines, Dome Mines, McIntyre Porcupine and Sogemines Development.

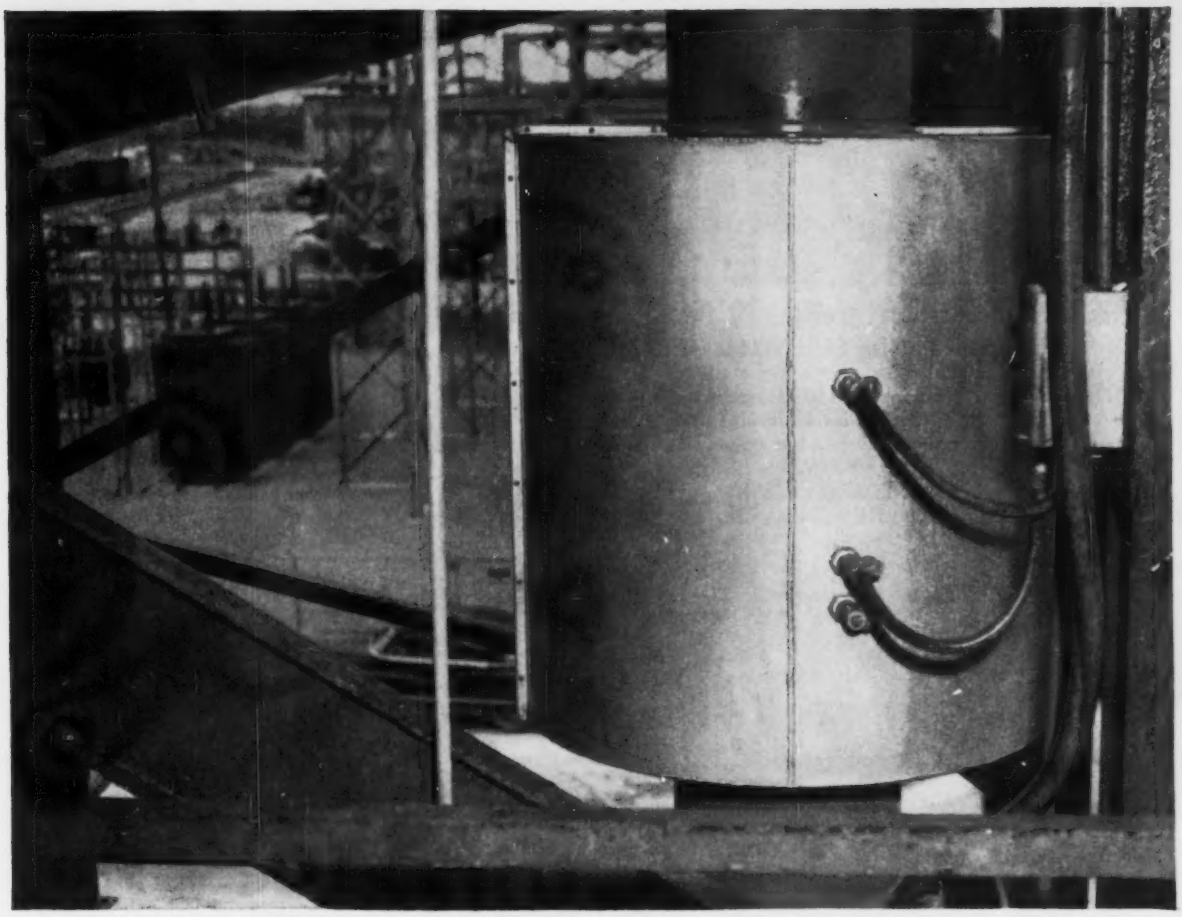
BRITISH COLUMBIA

Flake mica is being produced from a strip mine in the Rocky Mountain trench of British Columbia by Georgian Mineral Industries Ltd., as a "first" for Canada.

This is viewed by the Calgary-based mining company which owns and operates the mine, located near Mica Mountain, as a development which will result in reduced imports from the United States.

A $9-million Japanese contract came into focus last month with the announcement that Granby Mines Co. has purchased Silver Standard Mines Ltd. iron-ore property in the Queen Charlotte Islands.

The contract, under which the Sumitomo Shoji Kaisha Co. of Japan will take 1-million tons of ore and in return advance $500,000 in cash and up to $500,000 in machinery and equipment has been lying in abeyance since September while Silver Standard shopped around for more money.



This 16" Foxboro Magnetic Flow Meter meters phosphate rock slurry as simply as water. Magnetic meters have no flow restrictions of any type — measurement is made magnetically from electrodes flush-mounted in meter wall. In three years of continuous operation the only maintenance on this meter has been a liner replacement.

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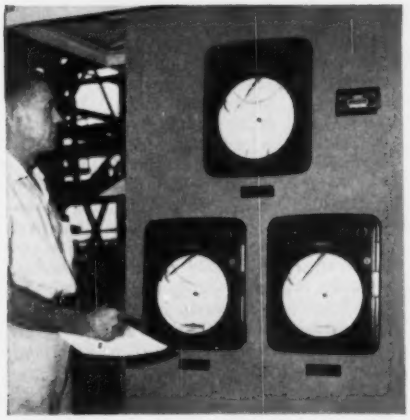

Control panel for International Mineral's Mass Flow System has 3 Foxboro Dynalog* Recorders. Bottom two record pipeline flow and solution density. Product of the two is then recorded on upper Dynalog *directly* in dry-tons-per-minute. *Reg. U.S. Pat. Off.

At The International Minerals & Chemical Corp., Bartow, Florida, phosphate rock slurry is pipelined from the mining operation to the flotation plant 5 miles away. Problem was, how to let mine head operators know how much rock to feed into the pipeline to maintain constant flow.

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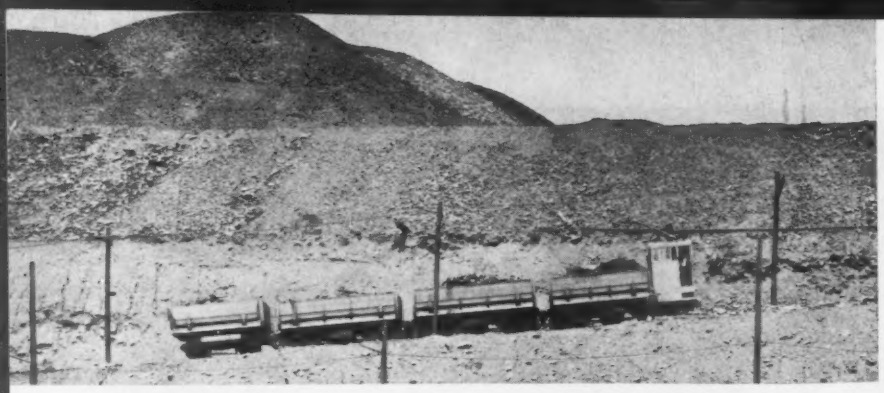

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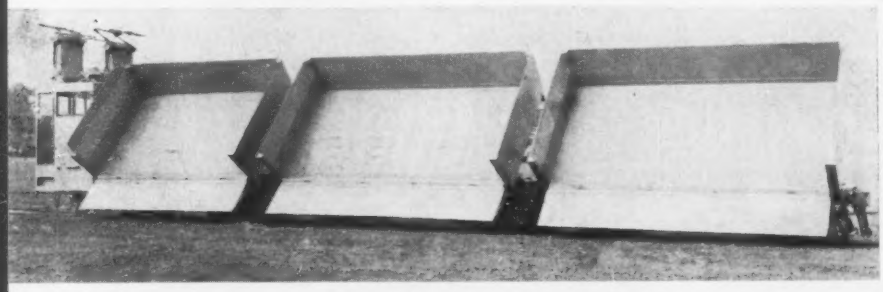

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B. C. (*Continued*)

Giant Mascot Mines plans to buy complete control of the Giant Nickel Mine, near Hope, for $475,000. Giant Nickel is owned jointly by Giant Mascot (51%) and Pacific Nickel Ltd. (49%).

Giant Mascot would pay $250,000 on completion of sale and the balance, with interest at 6%, in five monthly installments. If the deal goes through it is expected that the Giant Nickel and Pacific Nickel companies will be wound up. Giant Mascot will then take over operation of the mine.

Giant Nickel is currently making nickel concentrate shipments to Japan, which entered into a deal in 1959 to take the mine's output for three years. Estimates have placed the mine's production at 23,000 tpm. It is reported that the property will be worked out by October 1963.

Cowichan Copper Co. Ltd. has completed negotiations with Mitsui and Co. of Japan to mine, concentrate and market ore from the Sunloch and Gabbro properties at Jordan River, 40 miles west of Victoria.

Mitsui will provide up to $1-million and be repaid out of production over a maximum of four years.

The orebodies have been developed by Consolidated Mining and Smelting Co. of Canada Ltd. and developed reserves are estimated at 974,000 tons, assaying 1.8% copper.

Bralorne-Pioneer Mines Ltd. reported a slight decline in gold production in the last quarter of 1960. Ore milled at the Bralorne division was 38,642 tons for a recovery of 29,122 oz of gold compared to 38,936 tons and 32,018 oz in the third quarter.

IN LATIN AMERICA

ARGENTINA

New mineral deposits of over 30-million tons have been discovered in Cordoba province, about 400 miles north-west of Buenos Aires. The deposits of mineral bearing sands—containing monazite (4%) and various other metals—were located in the bed of the Rio Tercero by Argentine geologist Nestor Hillar.

Hillar revealed the deposits total about 31,680,000 metric tons containing an estimated 44% common sand, 45% gravel and "metallic dross," 4% monazite and 7% heavy minerals including ilmenite, zircon, scheelite, rutile and garnet.

The deposits are to be worked by the Cordoba provincial government, which will seek the cooperation of national and foreign private corporations.

BRAZIL

Standard Beryllium Corp. has purchased the Boa Vista concession which contains

Brazil (*Continued*)

indicated reserves of 14,820,000 tons of 3%-beryl ore. The 1700-acre concession, which is located about 200 miles north of Rio de Janerio, was purchased from Icombra, S.A.

Standard Beryllium plans to extract beryl and other minerals through the use of an automated mill, which has been ordered and will be installed in the near future. At least one more, and possibly two more mills, will be put into operation before the end of 1961.

One mill will process 100,000 tpy of the beryl-containing schist, worth about $2-million at present beryllium prices. Output of the mills will be in addition to the beryl that is cobbed by hand.

CHILE

According to the Copper Department, a government agency, the three American copper companies produced 479,000 tons of copper last year vs 497,000 tons in 1959. The medium and small copper mines produced 53,000 tons in 1960. The new El Salvador mine produced 85,000 tons of copper in 1960 vs 60,000 tons in 1959. The Potrerillos mine, which El Salvador replaced, only produced 36,000 tons in 1958.

In 1960, the Paipote copper smelter produced 22,246 tons of copper, a new record which represents an increase of 10% over 1959. A new 500-tpd copper flotation mill is being planned by the government for Paipote. Purpose of the new mill is to enable miners in the Copiapo region to exploit lower grade ores. The crushing plant of the Punta del Cobre mill, built over 30 years ago, is undergoing modernization and will be operating within a few months.

PHILIPPINES

Surigao Consolidated will erect a 150-tpd flotation mill for its new copper mine at Lepawan, Dumingay, Zamboanga del Sur. The company estimates about 120,000 tons of 2½ to 3% copper ore is in sight. A picking belt will be used to dispose of waste. Concentrates will be ground after having been passed through heavy media and the chalcopyrite floated. Nippon Mining Co. is advancing funds for mill and mine development and will buy the concentrates. The same company has readied its iron mine in Zamboanga del Sur for production.

Mining leaders have predicted a better year for the industry in 1961. Much of this optimism is based on the decision of the Central Bank to give temporary aid to the hard-hit gold mines, pending passage of a new subsidy law by the Philippine Congress. Under the new program the Central Bank will buy all the newly-mined gold at the effective free market rate of 3.60 pesos per dollar or equivalent of 126 pesos per oz. The mines can retain 90% of foreign exchange proceeds for their imports.

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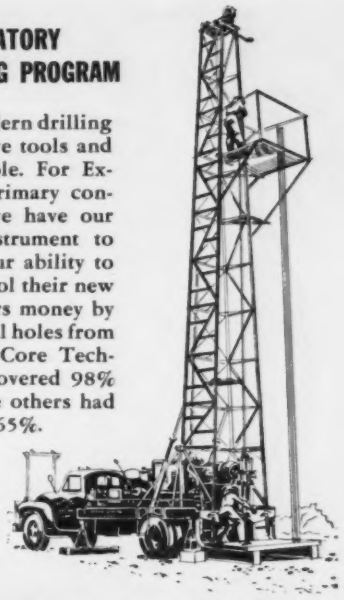

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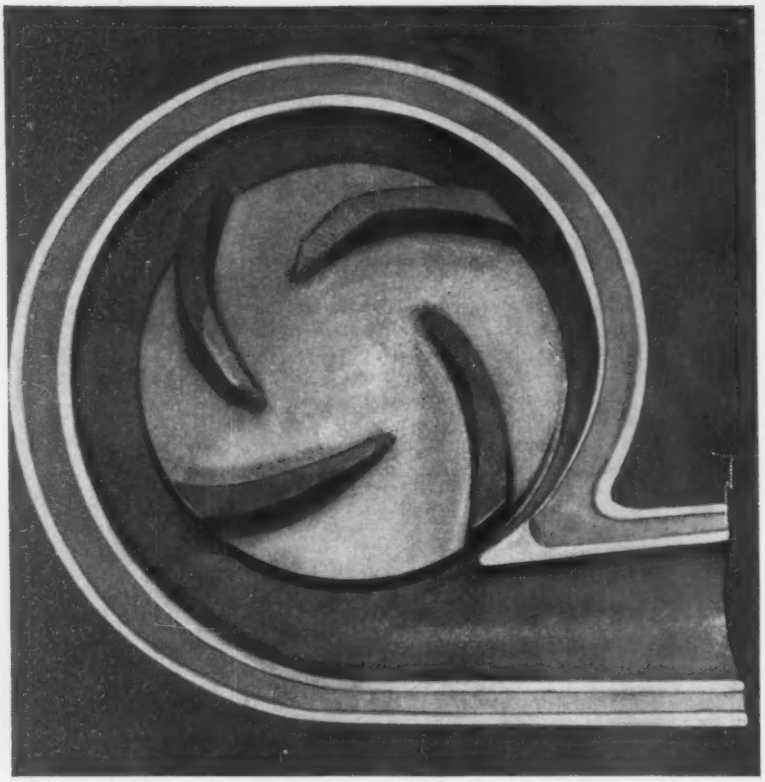

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Almanite W is a special martensitic iron and is an entirely new type of Meehanite metal possessing outstanding wear and abrasion resistance under both wet and dry conditions of service. It is now being used successfully as a replacement for high alloy cast irons and for carbon and manganese steels under abrasive conditions such as hydraulic mining.

The Almanite impellor shown was tested at Mt. Morgan Mining Company, Queensland, Australia in a Warman Cyclone Feed Pump used for the pumping of gravel sludges. Test results listed below demonstrate the superior service life of Almanite W over other materials in which this impellor was previously cast.

White Iron	*7 to 8 days*
Alloyed White Iron	*10 days*
Martensitic White Iron	*9 to 11 days*
28% Chrome Steel	*14 days*
Special Nickel Steel	*16 days*
ALMANITE W	*21 days*

Almanite W can readily be cast in all forms and shapes and is available through Meehanite foundries only. For more information, write to Meehanite Metal Corporation, 714 North Avenue, New Rochelle, New York.

MEEHANITE METAL

MEEHANITE CASTINGS ARE MADE ONLY BY MEEHANITE FOUNDRIES.

IN AUSTRALIA

Minerals output for 1960 is estimated by the Bureau of Mineral Resources, Geology and Geophysics of the federal government as follows: (in long tons)

Copper (content)	110,000
Gold (fine oz)	1,065,000
Iron ore	4,250,000
Lead (content)	305,000
Tin (content)	2.050
Ilmenite conc.	120,000
Rutile conc.	85,000
Zircon conc.	100,000
Tungsten (65% WO)	1,600
Zinc (in conc)	291,000

A list of all known iron ore deposits in Australia is being released by the Department of National Development in expectation of an iron ore export trade being developed. This follows the lifting of the complete embargo on the export of iron ore announced late last year.

IN AFRICA

The Ghana Government has recently announced proposals for the acquisition of the ownership of five of the seven gold mining companies in Ghana. The action is the result of a recently-passed bill, designed to safeguard the mineral reserves of Ghana by making it an offense for the holder of a mining concession to jeopardize or shut down any operable underground mine due to financial or other difficulties. The five mines had threatened to close unless the government loaned them funds to continue operations.

The five mines are: Bilbini Ltd., Amalgamated Banket Areas, Ariston Gold Mines, Bremang Gold Dredging and Ghana Main Reef. Unaffected are Ashanti Goldfields and Konongo Gold Mines.

Southern Rhodesia's mineral output reached a record level last year, amounting to $74,016,060. Most money—$21-million—came from asbestos, with gold production of $19.6-million next.

An 11-man technical mission has arrived in West Africa to conduct iron and steel complex feasibility studies which may lead to the first full scale development of that mineral complex in West Africa.

The mission—composed of representatives of Westinghouse, Koppers, United Engineering and Foundry, the Bechtel Corp. and Chase International Investment Corp.—is in Nigeria at the request of that government to study the quantities of iron ore recently found in Eastern Nigeria. The only coal in West Africa is also in Nigeria's Eastern Region.

Rhodesian Vanadium Corp. is temporarily reducing manganese mining to a minimum in the Fort Rosebery area of Northern Rhodesia, and is putting the mine on a care-and-maintenance basis.

The Corporation has mined 70,000 long tons of manganese ore since acquiring concession rights in the northern province in October 1955.

IN THE MIDDLE EAST

UAR

The Egyptian Iron & Steel Co.'s integrated steel mill at Helwan, near Cairo, the first in the Middle East, is going ahead with expansion plans to cut down initial high cost of production.

The company has invited international tenders for the supply of an ore concentration plant to be erected at Aswan, where the ore deposits are located, 600 miles from Helwan.

The company recently contracted with the Soviet Union, under the UAR-Soviet Economic and Technical Aid program, to set up a plant for the solidification of soft ore at Aswan.

By the end of 1961, iron ore from Aswan will be transported to Helwan by river barges as well as by rail.

The United Arab Republic's Atomic Energy Authority is intensifying the search for uranium in the deserts.

The AEA acquired two Ilyshin-14 planes from the Soviet Union to extend aerial magnetic reconnaissance surveys of the Egyptian deserts. The AEA already has one Ilyushin-14 supplied by the Soviets, with Russian technicians, and which has been surveying an area 30 miles south of Aswan.

ISRAEL

The Government owned Israel Mining Industries Mines has ordered $370,000 worth of additional machinery from Germany—a new step in its plan to increase annual production to 14,000 tons of 100% copper within five years. Of this quantity, 12,000 tons will be electrolytic copper, 500 tons—blister copper, and 1500 tons will serve for the production of copper sulphate.

This year's output will reach about 6000 tons of cement copper. Half of this copper is expected to be exported to Japan, and a first consignment of 1500 tons has recently been shipped there.

For the first time since establishment of the state, prospecting rights for phosphates were granted by government to a foreign company—the Albumina Corporation (US). The latter has in this connection established a sister-company, Israel American Phosphates Co and the agreement was okayed by the Cabinet.

It will be recalled that in addition to the mines already operated by a government company in the Negev desert, there are other phosphate deposits in the area that are to be located and evaluated. The American company has undertaken to invest, within two years, a minimum of 450,000 IL (roughly $220,000) in prospecting in three areas. If commercial deposits are ascertained, the company will get mining rights in two of the three areas. In such case, it will put up, within four years, a plant for processing at least 500,000 tpy of ore.

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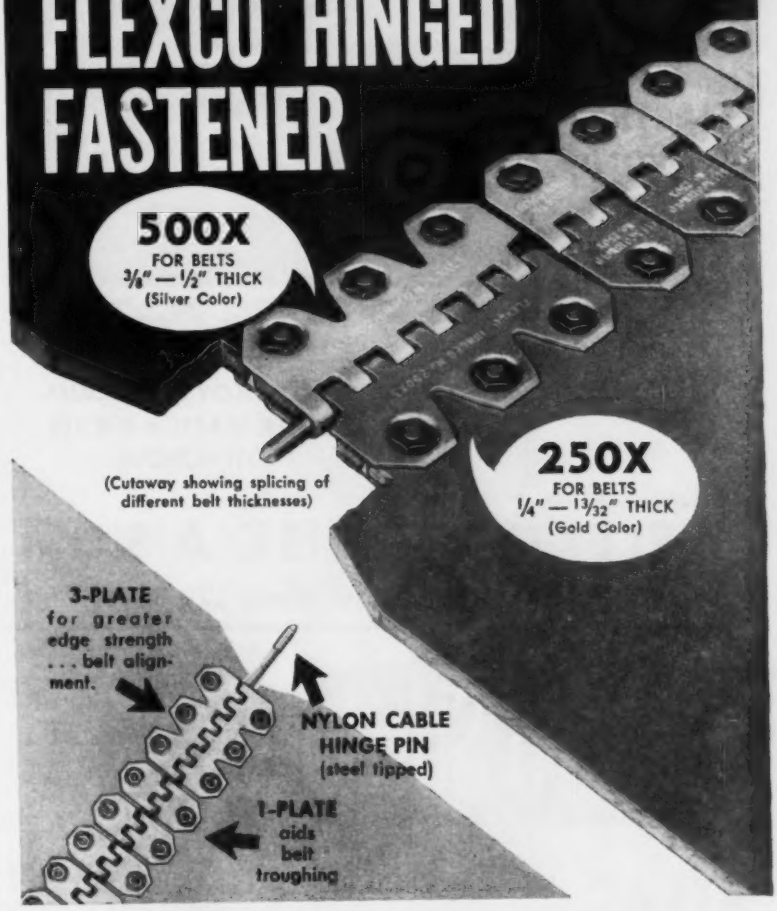

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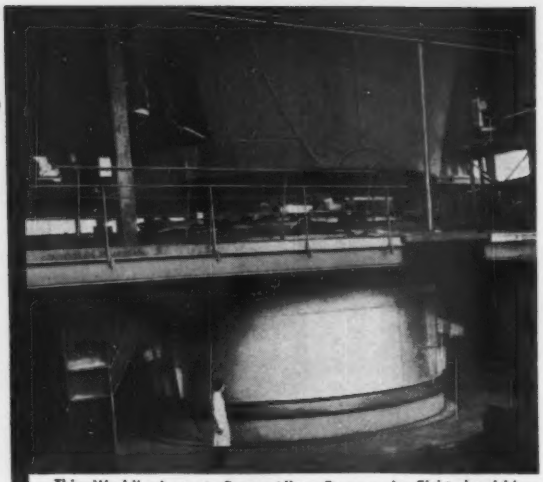

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FRANCE

Formation of "Societe Industrielle du Zirconium" has been announced in Paris by Montecatini, Pechiney, and Degusa and Metallgesellschaft. The new firm, with headquarters at 195 Faubourg St. Honore, Paris, will produce zirconium sponge and ingots and research applications in the nuclear and chemical industries.

EIRE

Irish, Belgian and Canadian interests are setting up a $11.2-million plant at Kilmokea, County Wexford, Ireland to produce sulphuric acid, superphosphates and purple (Cu-Fe) ore. The plant will produce 115,000 long tpy of 100% sulphuric acid, using pyrites from the St. Patrick's copper mines at Avoca.

The acid will be used with imported rock phosphate to make superphosphates and compound fertilizers, with the aid of ammonia from a planned $19.6-million nitrogenous fertilizer plant in the midlands of Ireland. A by-product, purple ore, will be used in a steel works' blast furnace or exported.

ITALY

In the first nine months of 1960 Italy produced 1361 metric tons of mercury, against 1109 metric tons produced during the corresponding period of 1959.

Production of mercury ore rose to 216,127 metric tons during the first nine months of 1960, against 171,769 metric tons during the corresponding period of 1959.

FINLAND

In mid-December 1960 after driving through 920 meters of granite, the orebody of the new under-sea Jussaro mine, off the south coast of Finland, was exposed. Production proper of the ore is due in March-April, and by the end of 1961, it is expected, the mine will be in full production. The ore is 27% magnetic iron ore.

LETTERS

History Repeats Itself

The news item on page 80 of your January issue was in error. There is no connection whatever between the new process for aluminum production which Aluminium Limited announced last July 25 and that of the two French producers, Pechiney and Ugine, which was revealed in the press about a month later.

While neither we nor the French companies have made public the details of our respective processes, it is evident

Letters (*Continued*)

from what has been published to date that they are based on quite different methods.

One cannot help but be reminded of 1886, in which year Charles Martin Hall in the United States, whose 100th birthday is being celebrated this year, and Heroult in France, completely independently of one another, developed the same basic aluminum reduction process that is still in use today.

Now, 75 years later, history has repeated itself, and once again in North America and in France, two new processes for aluminum reduction have been announced—only this time they are not the same, but quite different.

William V. Lidgerwood
Aluminium Limited Sales, Inc.

More About Direct Reduction

I read with great interest your report on Direct Reduction of Iron Ore (E&MJ, December 1960). Your summaries of various processes and your general discussion of DR with its possible place in the industry were excellent.

I have given considerable thought and research to DR extending over many years and am personally impressed with the superiority of hydrogen (90%+ in mixed gases) as a reducing agent. Also I believe in lump ore or sintered fines for charge. Such material is entirely satisfactory for hydrogen reduction and the product is readily handled for subsequent melting.

A brief paper summarizing several years work by me or under my supervision was published by E&MJ in January 1952. We worked on coarse and fine ores and a variety of sinters using solid carbon, water gas, hydrogen and various other gas mixtures. The best results were obtained with hydrogen or mixtures with more than 90% hydrogen.

The equipment described and illustrated in the above paper was a vertical stainless steel tube, 1 ft in diameter and 9 ft long with open top and with bottom dipping as a seal into a pan of water. A section at the middle was heated by an annular chamber fired by thermostatically controlled gas burners. Cold ore was fed at the top and withdrawn at brief intervals from the water bosh at the bottom. Cold hydrogen was introduced through peripheral tubes at the bottom and the excess burned continuously at the top. The hydrogen passed upward over the descending charge and was thus preheated before reaching the reducing zone. Similarly the cold ore was preheated by the hot gasses ascending from the reducing zone. The economics of heat exchange are thus utilized.

We reduced a total of 20 tons of various material in this equipment. By careful regulation of all the factors, we were able to maintain the desired 1550-1650°F in the reducing zone and overcome the difficulties with sticking of the charge which have troubled many investigators attempting to use a continuous vertical furnace. Where the furnace was in regu-

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The large diameter, short-length trunnions used on Hardinge Conical Scrubbers permit chute feeding of unsized ore and rock at rates up to 800 tons per hour. The superincumbent mass action of the charge quickly slurries the clay and dirt, permitting ready separation on washing screens or trommels.

Hardinge Scrubbers are in wide use in cleaning such diversified materials as limestone, phosphates, iron ore, river gravel, ganister rock, dolomite, abrasives, and in separating clay from rock and gravel.

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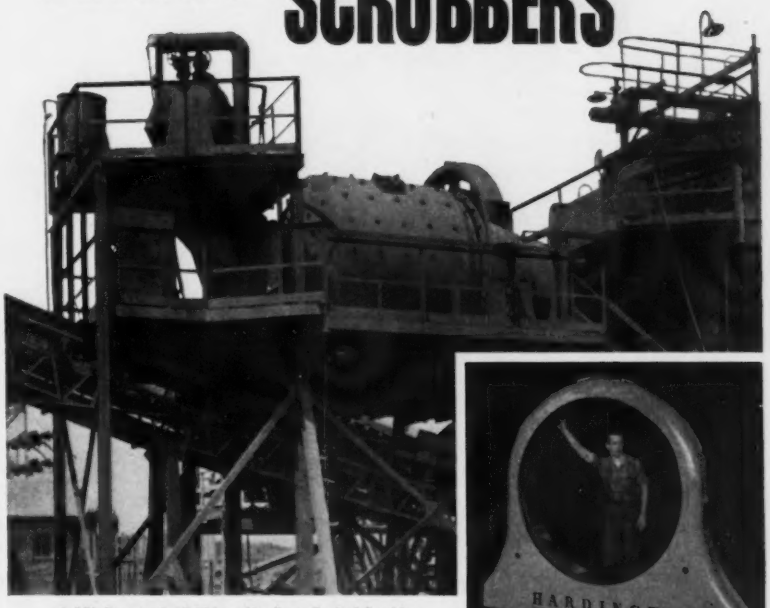
CONICAL SCRUBBERS



A 10′ diameter by 84″ long Hardinge Conical Scrubber scrubbing 5″ iron ore.

A Hardinge Scrubber bearing—inside diameter 60″.

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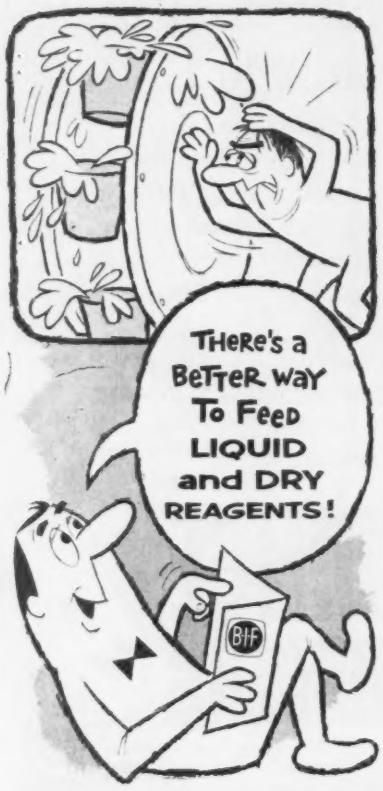

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Letters (*Continued*)

lar operation there was a surprisingly small consumption of gas in the external heating chamber.

This simple continuous equipment, when enlarged and perfected, would lend itself to almost push button operation. Complete reduction of the ore is possible, but much more rapid operation is obtained with 90- to 95% reduction.

I can see few advantages for DR except for the highest grade ores or sinters. When these are available in an area where hydrogen production is economically feasible (there are such conditions), there seem to be many good reasons for its use.

Among the materials reduced, in the experiments described, was sinter made from pyrite cinder. Excellent results were obtained. Pelletized material such as that now being produced by Inco was not tried, but it should behave with similar satisfaction. Perhaps the great sulphide areas of Canada where good coking coal is not abundant will become good ground for DR development. Equipment similar to the above has been used successfully to reduce briquetted tin ore concentrates. In this case a mixture of hydrogen and steam was used as reducing agent.

Carle R. Hayward
Department of Metallurgy
Massachusetts Institute of Technology

Blasting Agent Blasted

We are anxious to establish that fertilizer grade ammonium nitrate is not an explosive. Fertilizer grade ammonium nitrate should not be confused with blasting agents containing ammonium nitrate as one of several components.

Fertilizer grade ammonium nitrate is an oxidizing material and can support combustion if involved in a fire with combustible materials. With simple precautions fertilizer grade ammonium nitrate is stored safely at the plant, in distributors' warehouses, or on the farm. As in the case of an oxidizing agent which stimulates the burning of combustible materials, fertilizer grade ammonium nitrate deserves common sense treatment during transportation, storage and use, but this product can be handled with complete safety if the simple and reasonable precautions recommended are observed.

We are not unmindful that there is confusion with regard to ammonium nitrate, undoubtedly stemming from the fact that it is being used as an ingredient in blasting agents. However, it must be remembered that this use involves mixing ammonium nitrate with some carbonaceous materials such as fuel oil, adding a booster (usually dynamite) and finally, an initiator. This mixture should not be referred to as fertilizer grade ammonium nitrate.

Louis H. Wilson
Secretary and Director of Information
National Plant Food Institute

(Continued on p. 162)

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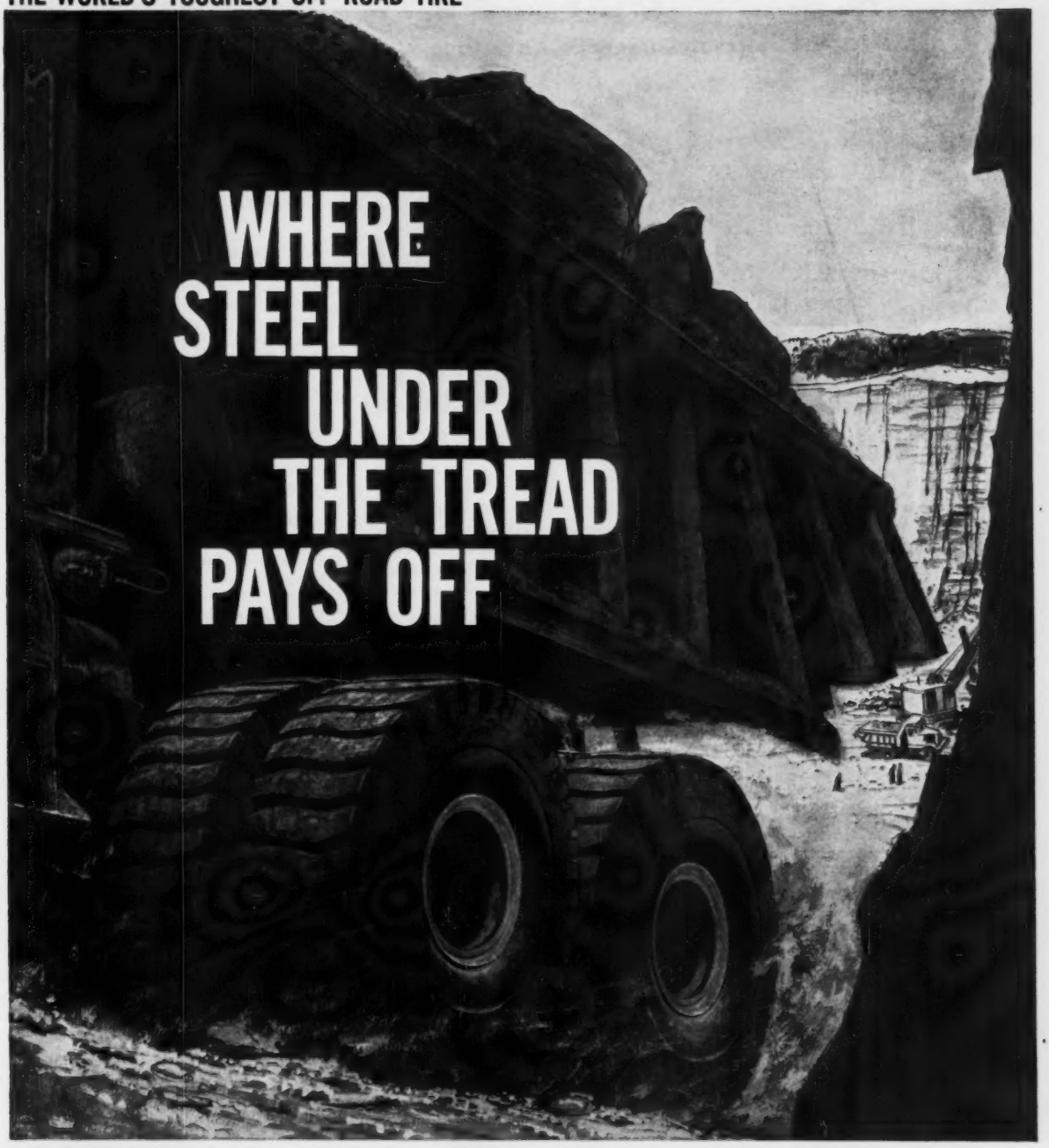

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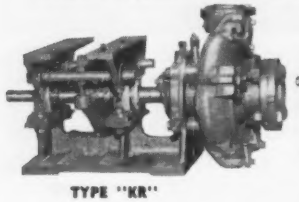

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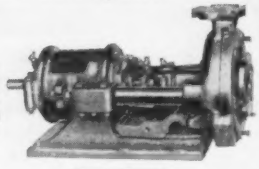

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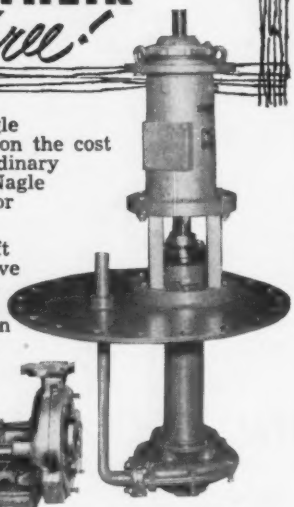

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Letters *(Continued)*

Correction

In the article on "Aluminum" appearing in the February issue of E&MJ, on p 80, the following figures should have appeared:

U.S. share of world production	39.0%
Soviet Bloc share	22.5
Soviet Union increase in output in 1960 over 1957	50%

Skip System Economics

We have just received our copy of the January issue of *Engineering & Mining Journal* and are interested in your article "Mining Practice—Better Techniques From Better Equipment."

On p 91 you have mentioned Rockover Skip Systems which are made by National Iron Co. We are greatly disturbed by the material in the last two paragraphs of the skip article. We fail to follow your comments that operators have rejected skip installations "because of the high initial cost (about $2-million for the installation) and the low load capacity of the skips (25 tons at Liberty Pit)."

There has been only one skip system which ran near $2-million and this order was recently obtained by National Iron. The other systems we have in operation have all cost very much less than this figure. This recent system is much more elaborate than any of the others and will probably be unique to this one property. The unique character of this system is the main reason for its cost.

We have offered skip systems to some of the smaller producers for considerably below $500,000.

Potential customers, or at least those seeking initial information on Rockover Skips, could be led to feel that we are limited to 25-ton capacity skips at a cost of $2-million. This certainly is not the case . . . We have capacities up to 50 tons . . .

We cannot help but feel that the comment about long-term basis of property analysis would be most misleading. Actually, there are Rockover Skip Systems in operation where haulage cost savings have paid for the system in a matter of a very few years—in much less time than is normally associated with writeoffs of mining equipment.

L. J. Carrier, Sales Manager
National Iron Co.

E&MJ's intention was not to mislead its readers concerning the value of skips in open pits.

In fact, two feature articles have appeared in the magazine (March 1958, p 98 and May 1960, p 105) which discussed profitable installations in detail.

Safer Hard-Hats

We have a safety question that we feel should be posed to every underground mining operation in the industrial world: Does the present hard-hat furnish all the head protection necessary to an un-

Letters *(Continued)*

derground worker? We say "NO." In the past four years, we've talked to a lot of mining people, hard-hat manufacturers, plastics representatives, safety personnel. The consensus is that the present hard-hat is *not* complete protection, but nobody does anything about it.

Some shortcomings of the present hard-hat for certain jobs are:

1. Incomplete coverage of skull and face. We have had fractured cheekbones, basal skull injuries and lacerated ears that would have been prevented by greater head-coverage.
2. Suspension harnesses do not give enough stability to the hat. We have injuries in our records, including fatal ones, that would have been greatly minimized if the hard-hat had stayed on the man's head.
3. The wearing of chin-straps is objectional. We are well aware of the chafing effects of chin-straps underground, and the difficulty of enforcing this rule.

Our idea is that a hard-hat fashioned after a football helmet would more nearly meet the need for full head protection than do present models. Even without a chin-strap, the helmet's sides lightly hug the cheeks and prevent the hat from coming off in a fall. In addition, it is ideally shaped for built-in ear-defending devices. On the negative side, problems of worker acceptance, ventilation and weight enter the picture. However, these problems could be overcome in time.

Mr. C. H. Gallaway, vice president of the safety products division, American Optical Co., indicated to me that his company was contemplating the manufacture of hard-hats. He said that if there were enough national support to show a need for a safer hard-hat, his company would explore the situation.

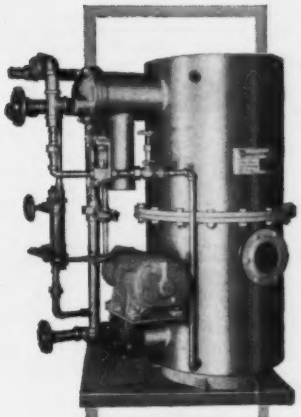
J. R. Gareau
Safety Manager
Calumet and Hecla, Inc.

Additional Beryllium Sources

Your article on beryllium was very interesting, but why did you leave out of your maps the good beryl deposits around here? From the Hogg mine, which we own, over 150 tons of beryl ores were mined and shipped to the government buying office at Spruce Pine, N.C., since 1954. We are planning to resume production this winter, both from the Hogg and several other good local prospects.

Louis MacLoon
Manager, Plantation Materials Co.
LaGrange, Ga.

We regret that we did not include definite mention of the Hogg mine and others in your area, but it was not listed on the information available to us. There has been no single complete map on beryllium resources, so we compiled the one on the U.S. which we published—Editor



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1—20 NM2C Ing. Rand, 2 drum, 20 H.P. 440 V.
1—CA 311 Sullivan, 3 drum, 50 H.P. 440 V.
1—CF 211 Sullivan, 2 drum, 50 H.P. 440 V.
10—HB Gardner Denver, 1 drum, Air
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1—12" x 18" Denver duplex
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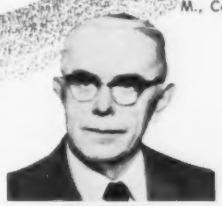

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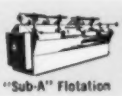

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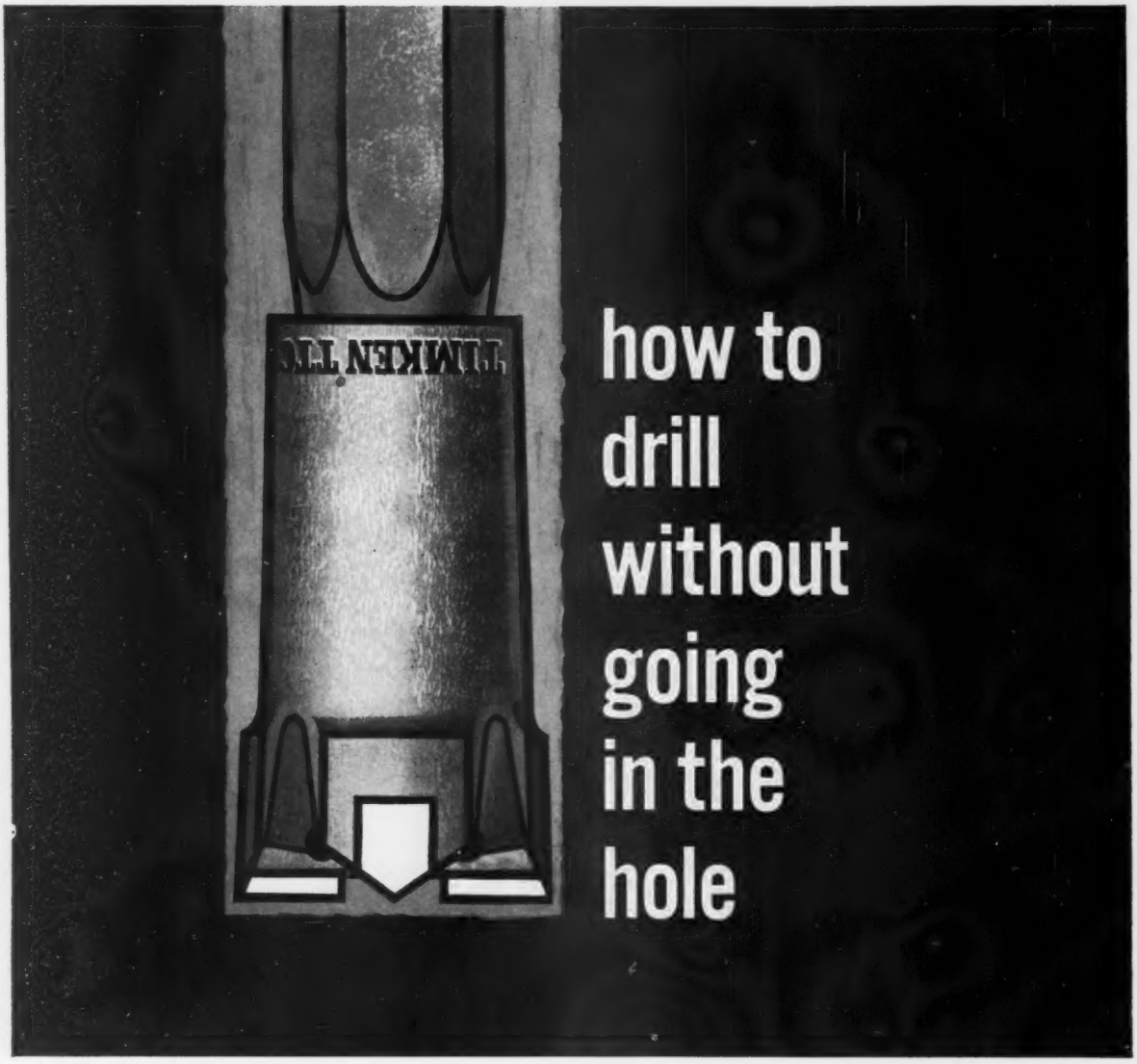

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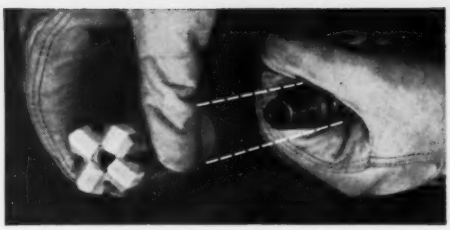

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